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FRANCIS WOLLE'S FILAMENTOUS MYXOPHYCEAE

BY

FRANCIS DROUET

CURATOR OF CRYPTOGAMIC BOTANY

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BY FIELD MUSEUM PRESS

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FRANCIS WOLLE'S FILAMENTOUS MYXOPHYCEAE[1]

FRANCIS DROUET

FEB 15 1940 SCHROEPEL

In 1936, Professor Wm. Randolph Taylor suggested that I examine, among other historical collections of filamentous Myxophyceae, the specimens of Francis Wolle on file in the Herbarium of the University of Pennsylvania. The study was gradually extended to include material bearing Wolle's annotations in other North American and European herbaria. The observations now presented are designed to interpret in modern nomenclature many novelties and reports of species which Wolle published in this group of algae.

Francis Wolle[2] (1817–1893) was a minister and educator of the Moravian Church in Bethlehem and Nazareth, Pennsylvania. He became interested in natural history at an early age; his first serious work among cryptogams was on local bryophytes, in company with his friend, Eugene A. Rau of Bethlehem. When Wood's *Contribution to the Fresh-water Algae of the United States* appeared in 1872, he turned his attention to these algae and especially to the desmids. He made large collections in Pennsylvania, New York, and New Jersey and reported his findings in a series of short papers in the *Bulletin of the Torrey Botanical Club* and the *American Monthly Microscopical Journal* during the years 1875–1885. He entered into correspondence with many contemporary phycologists, including F. Hauck, Anton Hansgirg, Otto Nordstedt, and W. G. Farlow. H. W. Ravenel, J. Donnell Smith, Romyn Hitchcock, F. W. Anderson, and various less active collectors sent all of their freshwater algae to him for determination. He issued hundreds of duplicate specimens in exchanges with these and other workers and thus built up a considerable working herbarium of both European and American algae. His studies in the desmids led him to publish in 1884 a volume entitled *Desmids of the United States;* this he revised and enlarged in 1892. In 1887 he published a two-volume work on the freshwater Myxophyceae, Rhodophyceae, and Chlorophyceae, *Fresh-water Algae of the United States.* With I. C. Martindale he furnished lists

1939 cont. v. 20[2-3] div. ex. Jan 39

[1] Contribution from the Osborn Botanical Laboratory of Yale University, the Department of Botany of the Marine Biological Laboratory, and Field Museum of Natural History.

[2] For biographical data, see Appleton's *Encyclopaedia of American Biography* 6: 590 (1889); *The Moravian* (Bethlehem) 38: 97, 103 (1893); Bot. Gaz. 18: 109–110 (1893); and Proc. Amer. Microsc. Soc. 15: 245–246 (with photograph) (1894).

of algae for Britton's two catalogues of New Jersey plants (see below). The publications mentioned above were based almost entirely upon material which he had examined himself and which is preserved for us today in his own and his correspondents' herbaria. His one purely bibliographic work, *Diatomaceae of North America*,[1] appeared in 1891.

As the most voluminous writer on North American algae during the 1870's and 1880's, Francis Wolle excited considerable interest in the freshwater algal flora of the United States. Although he was not a botanist by profession, his accumulated herbarium and his wide acquaintance among phycologists afforded him excellent advantage for careful and meticulous work. His taxonomic concepts, as indicated by annotations upon specimens of Myxophyceae, are on the whole similar to those in use today; this fact is unfortunately obscured in his publications by an often unconventional style of writing and by the use of a contemporary nomenclature which is scarcely intelligible to us unless we consult his specimens.

Wolle's studies of Myxophyceae were in major part already completed before Thuret, Bornet, Flahault, and Gomont published their monumental treatises upon which our present understanding of the morphology and nomenclature among the filamentous forms is based. He worked in an age when the most usable manuals of algae were those of Kützing and Rabenhorst, in which were listed hundreds of

[1] Francis Wolle accumulated a very small number of diatoms in his herbarium and consulted but few actual specimens during the preparation of this book. It is evident that he had no particular interest in the group and that he wrote the volume for the sole purpose of completing his series of manuals of North American freshwater algae, not as a report of original research. He writes in the preface: "In the present volume is collected the cream of what has already been written on the subject, as well as the figures of all known American species together with the most approved system of classification." In a copy of Habirshaw's *Catalogue of the Diatomaceae* (1885) in Francis Wolle's library, Dr. H. H. Chase had underlined in red ink the species known to occur in North America. Wolle found illustrations in other publications for the species included in this list. Most of the pen-and-ink drawings of his original plates (now in the possession of Mr. Philip W. Wolle) are direct copies or outline tracings of figures in Schmidt's *Atlas der Diatomaceen-Kunde*, pls. 1–140 (1874–80). Other figures are obviously enlarged free-hand sketches of those of Van Heurck, *Synopsis des Diatomes de Belgique* (1885). The finished enlargements give the impression of having been made by someone not too sympathetic toward and appreciative of the details of diatom morphology, especially where shapes of cells and position, number, and size of markings are concerned. The figures thus copied from Van Heurck are at best inaccurate, and in some cases quite unlike the species which they were designed to represent. Some of Wolle's figures are original, drawn, according to Mr. Philip W. Wolle, from the published slides of H. L. Smith, *Diatomacearum Species Typicae* (1874 ff.). The preface to his book states that Francis Wolle submitted the plates to Dr. H. L. Smith for approval before they were photolithographed. Letters which passed between the two men on this subject appear to be lacking in the files of Rev. Wolle's correspondence.—RUTH PATRICK, ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

species and many genera distinguished from each other by means of characters either highly imaginative or of little importance in the classification now in vogue. Such chaotic taxonomy had a natural sequel in the popularity of theories of polymorphism among the algae, like those elaborated in Hansgirg's 'Ueber den Polymorphismus der Algen', Bot. Centralbl., Bd. xxii (1885), and in the preface to Wolle's *Fresh-water Algae*. In general these theories presupposed that there is no limit to the series of diverse morphological forms which might be assumed by a single species in the course of its complete life history. They were truly revolutionary ideas, which claimed the enthusiasm of many respected European workers on algae; they provided a colorful and plausible *raison d'être* for the vast array of species and genera in the manuals of the time. Wolle employed the nomenclature of Kützing, Rabenhorst, and Kirchner in his publications because there was no other to use; with this fact in mind, the student today need not be astonished that Wolle considered many of the species listed in his *Fresh-water Algae* as equivocal entities.

If we wish to understand the uninformative descriptions and often ambiguous nomenclature in the filamentous Myxophyceae of Kützing's *Species Algarum* (1849) or of Rabenhorst's *Flora Europaea Algarum* (1864–68), we find it wise to examine for ourselves the specimens upon which these authors based their descriptions or to consult the works of the few authors who have done so. Bornet & Flahault, in their *Révision des Nostocacées Hétérocystées* (1886–88), and Gomont, in his *Monographie des Oscillariées* (1892–93), in establishing the modern system of classification and nomenclature in the group, have interpreted most of these specimens in careful scientific language in accord with present ideas of morphology and life histories. Unfortunately, but few of Wolle's specimens fell into the hands of these authors. Setchell in Erythea 4: 189–194 (1896) and ibid. 7: 45–55 (1899) explained a number of additional specimens which had been cited in Wolle's publications. Otherwise, Wolle's Myxophyceae have remained unexamined and uninterpreted for half a century; as a consequence, reference to his publications in recent literature has been largely a source of confusion. A general disinterest in herbarium study of microscopic algae since 1900 and an increasing popularity of bibliographic research among phycophiles have brought about this state of affairs, much to the detriment of Francis Wolle's scientific reputation. In Forti's *Sylloge Myxophycearum* (1907) we find Wolle's now unintelligible descriptions copied

verbatim, often with errors of translation, transcription, or typography. Forti's Latin interpretations have again been translated into English, German, and other languages in recent manuals devoted to Myxophyceae. Students using these manuals find themselves confronted with a hodge-podge of species, the descriptions and figures of many quite uninformative. With the specimens of Wolle and other early authors carefully preserved and easily accessible in herbaria, there would seem to be little reason why such confusion should have existed for so long a period of time.

For a number of years after his death, Francis Wolle's herbarium and other possessions remained in the hands of his family in Bethlehem. In December, 1906, some two-thirds of the collection, numbering several thousand specimens, was presented to the University of Pennsylvania, where it has remained in the Herbarium ever since. The rest of the specimens, along with the scientific library, notebooks, and instruments, have been carefully preserved by his grandson, Mr. Philip Weiss Wolle of Princess Anne, Maryland. Very recently Mr. Wolle placed all the specimens still in his care on file in Field Museum of Natural History.

Specimens bearing Francis Wolle's annotations are to be found in considerable numbers in the herbaria of those botanists who received material in exchanges or who sent specimens to Wolle for determination. The Farlow Herbarium contains many such specimens received by W. G. Farlow. The United States National Herbarium contains the herbaria of J. Donnell Smith and Romyn Hitchcock. The New York Botanical Garden has much Wolle material from the personal collection of Eugene A. Rau. The Herbarium of Oberlin College contains the accumulated collection of F. D. Kelsey. Specimens studied by Prof. W. A. Setchell are on file in the Herbarium of the University of California. Specimens of H. W. Ravenel are to be seen in greatest abundance in the British Museum (Natural History) and in the Farlow Herbarium. Other material is in the Brooklyn Botanical Garden and the University of Michigan Herbarium. It is more than probable that specimens exist in other North American and European herbaria not consulted in this study.

The specimens of blue-green algae which passed through Wolle's hands are dried on paper or inclosed in envelopes. They are labeled with specific determinations in his handwriting, and commonly with notations of place, habitat, etc. In many instances the notes appear on the back of the mounting paper. Along with other data, letters or numerals are often to be noted; these refer to entries in his admir-

able series of illustrated notebooks or to pages and figures in publications consulted. Printed labels are attached to many specimens.

The scientific names used in Wolle's earlier papers are in general the same as those which appear on the labels of his specimens. Some of those of the *Fresh-water Algae,* however, cannot be correlated with specimens because changes in his nomenclature do not appear on the herbarium labels or in the notebooks, and because certain names employed in earlier papers are disregarded in the citation of synonymy in the book. Such names which have not been matched with specimens appear at the end of this paper in the list of *Inquirenda.* Many specimens bear incomplete labels; it is probable that this material is the basis for certain of the dubious reports included in this list. Future investigations may discover the missing data for some of the specimens, and the list may be further shortened by the finding of additional Wolle specimens in herbaria not here consulted. A few records of species cited in the *Fresh-water Algae* are admittedly dependent upon the specimens of H. C. Wood, the location of whose herbarium is unknown to us at this time.

For convenience and to avoid repetition of such records as appear in Tilden's *Myxophyceae of North America* (1910), I have omitted reference in the treatment below, except in certain special cases, to Forti's *Sylloge Myxophycearum.* Likewise, reference to Wolle's list of freshwater algae in Britton, *A Preliminary Catalogue of the Plants of New Jersey* (1881) is omitted because the same list of species in revised form is repeated in Britton, Final Rep. State Geol. New Jersey, vol. ii (1889). No reference is made to VanDersal & Cartledge, Proc. Pennsylvania Acad. Sci. 7: 1–7 (1933), in which Wolle's Pennsylvania records are copied.

I wish to express my gratitude for the co-operation of many persons during the course of this study: some have supplied invaluable information concerning Francis Wolle and his specimens; these and others have offered suggestions and performed numerous other courtesies. Among the many who have aided me I wish to thank especially Mr. Philip W. Wolle, Prof. Wm. Randolph Taylor, Prof. Wm. A. Setchell, Prof. John M. Fogg, Jr., Dr. Ruth Patrick, Prof. Charles Hodge, Mrs. Hartley C. Wolle, Prof. Tracy E. Hazen, Dr. Wm. N. Schwarze, Dr. B. E. Dahlgren, Dr. Julian A. Steyermark, Mr. Donald Richards, Miss Sophia Prior, Prof. Frederick Grover, Dr. F. R. Fosberg, Miss Rosalie Weikert, Dr. D. H. Linder, Dr. Ray Dawson, Dr. Vivian Trombetta, Dr. H. K. Svenson, and Dr. Wm. R.

Maxon. This work, in large part, was made possible through the aid of the Theresa Seessel Research Fellowship at Yale University.

In the citation of specimens below, herbaria are indicated by means of the following abbreviations: B, Brooklyn Botanic Garden; BM, British Museum (Natural History); C, Herbarium of the University of California; D, my personal herbarium; F, Farlow Herbarium of Harvard University; FM, Field Museum of Natural History; G, Herbarium of Goucher College, Baltimore; Mi, Herbarium of the University of Michigan; N, New York Botanical Garden; O, Herbarium of Oberlin College; P, Herbarium of the University of Pennsylvania; Pa, Academy of Natural Sciences, Philadelphia; PW, the collection of Philip W. Wolle in Field Museum of Natural History; T, Herbarium of Wm. Randolph Taylor; U, United States National Herbarium. Specimens cited without name of collector are to be understood as containing no such data or as bearing the name of Francis Wolle. For the sake of brevity I mention only the surnames of Dr. H. W. Ravenel, Capt. John Donnell Smith, Dr. C. F. Austin, and Dr. Romyn Hitchcock. Throughout the treatment the abbreviation 'F. W. Alg.' is employed in place of Wolle's *Fresh-water Algae of the United States* (1887).

Stigonemataceae

STIGONEMA MAMILLOSUM (Lyngb.) Ag. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 77 (1887). *Stigonema multipartitum* Gardn., Univ. Calif. Publ. Bot. 14: 9 (1927). *S. robustum* Gardn., loc. cit. (1927). *S. contortum* Gardn., ibid. 11 (1927). *S. canadense* Wm. R. Taylor, Proc. Acad. Nat. Sci. Phila. 80: 94 (1928). *S. mamillosum* f. *robustum* Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 5 (1939).—Recent studies of considerable material of this species from Europe, both Americas, and Asia, including the original material upon which the above names are based, point to the conclusion that plants with slender filaments and those with broad filaments are but growth forms of a single variable species often in various stages of lichenization. Specimens seen: NEW JERSEY: stones, shore of lake (O); on rocks in stream, Sandfield, *Austin*, 1871 (P); Green Pond, 1880 (N); 'Sirosiphon lacustris' (P).

References: as *Sirosiphon coralloides* in Wolle, Bull. Torr. Club 6: 185 (1877), ibid. 8: 29 (1881), F. W. Alg. 270 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *S. lacustris* in Wolle, Bull. Torr. Club 6: 185 (1877); as *S. pulvinatus* in Wolle, F. W. Alg. 268 (1887) in part; as *Stigonema informe* in Tilden, Minn. Alg. 1: 249 (1910) in part.

STIGONEMA INFORME Kütz. ex Born. & Flah., ibid. 5: 75 (1887).—Specimens seen: PENNSYLVANIA: 'Scytonema callitrichoides' (P); rocks, Onoko, July 1875 (D, P); wet rocks (N, U); July, Nov. 1875 (F). MARYLAND: Falls of Deep Creek, Garrett County, *Smith*, July 1878 (P, U).

References: as *Sirosiphon alpinus* in Wolle, Bull. Torr. Club 6: 185 (1877); as *S. pulvinatus* in Wolle, F. W. Alg. 268 (1887) in major part; as *S. pulvinatus* f. *alpinus* in Wolle, ibid. 269 (1887) in part; as *Stigonema informe* in Setchell, Erythea 4: 191 (1896), in Tilden, ibid. 249 (1910), in part, in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 5 (1939).

STIGONEMA MINUTUM (Ag.) Hass. ex Born. & Flah., ibid. 5: 72 (1887). *Sirosiphon lignicola* Wood ex Born. & Flah. pro. synon., ibid. 5: 73 (1887); Wood, Proc. Amer. Philos. Soc. 11: 133 (1869). *S. acervatus* Wood ex Born. & Flah. pro. synon., loc. cit. (1887); Wood, ibid. 132 (1869). *S. pulvinatus* f. *mamillosus* Wolle,[1] F. W. Alg. 270 (1887).—Specimens seen: PENNSYLVANIA: Onoko, 1875 (F, P); shaded rocks (C, D, P); 'Stigonema minutum var. saxicola' (Wittr. & Nordst., Alg. exs. 669, N, PW); 'Sirosiphon compactus' (P). MARYLAND: Deep Creek, Garrett County, *Smith*, July 1878 (U). WEST VIRGINIA: Blackwater, Tucker County, *Smith*, July 1878 (U); Blackwater Fork of Cheat River, *Smith*, July 1878 (U). SOUTH CAROLINA: on boards, Aiken, *Ravenel 39* (ISOTYPE of *Sirosiphon lignicola*, C), *76* (F), *240* (P), *375* (F); Aiken, *Ravenel 146* (F), *547*, *549*, *550*, Dec. 1884 (PW); granite walls, Aiken, *Ravenel 498*, Nov. 1883 (F); in running water, Aiken, *Ravenel 74*, Apr. 1869 (C); Aiken, on bark of trees, *Ravenel 107*, (C), *109* (BM); on limbs of Nyssa, *Ravenel 169* (C); on bark of *Ilex opaca*, *Ravenel 44* (ISOTYPE of *Sirosiphon acervatus*, C); on Ailanthus, Aiken, *Ravenel 300* (BM); on pine boards, St. Johns, Berkeley Parish, Charleston, *Ravenel 339*, Mar. 1880 (F).

References: as *Stigonema minutum* var. *saxicola* in Wolle, Wittr. & Nordst. Alg. exs. 13: 669 (1883); as *Sirosiphon pulvinatus* f. *alpinus* in Wolle, F. W. Alg. 269 (1887) in part; as *S. compactus* in Wolle, ibid. 271 (1887) in part; as *S. lignicola* in Wolle, ibid. 273 (1887) in part; as *Stigonema minutum* in Setchell, Erythea 7: 47 (1899), in Tilden, Minn. Alg. 1: 248 (1910), in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 4 (1939); as *S. tomentosum* in Tilden, ibid. 246 (1910).

STIGONEMA PANNIFORME (Ag.) Born. & Flah., ibid. 5: 71 (1887). *Sirosiphon argillaceus* Wood ex Born. & Flah. pro. synon., loc. cit. (1887); Wood, Smiths. Contrib. Knowl. 241: 73 (1872).—Specimens

[1] I find no specimens labeled thus, but it appears certain that the West Virginia specimens labeled *S. alpinus* and cited here form the basis of the description and figure of *S. pulvinatus* f. *mamillosus*. Mixed with *Stigonema minutum* in this material are poorly developed filaments possibly referable to *S. informe* Born. & Flah.

seen: SOUTH CAROLINA: damp clay, Aiken, *Ravenel 79* (ISOTYPE of *Sirosiphon argillaceus*, F), *216*, *225* (F, P), 544 (PW).

References: as *S. compactus* in Wolle, F. W. Alg. 271 (1887) in part; as *S. argillaceus* in Wolle, ibid. 273 (1887); as *Stigonema panniforme* in Tilden, Minn. Alg. 1: 245 (1910) in part.

STIGONEMA OCELLATUM (Dillw.) Thur. ex Born. & Flah., ibid. 5: 69 (1887). *S. anomalum* Blanchard,[1] Rhodora 15: 194 (1913).—Specimens seen: NEW JERSEY: 'Sirosiphon ocellatus' (D, N); 'S. Crameri' (P); old path, Closter, Nov. 1877 (P); with *Hapalosiphon pumilus*, Bamber, Ocean County (P); in Bamber Lake, 1883 (Wittr. & Nordst., Alg. exs. 668, PW, N).

References: as *Sirosiphon ocellatus* in Wolle, Bull. Torr. Club 6: 285 (1879), Wittr. & Nordst. Alg. exs. 13: 668 (1883), F. W. Alg. 272 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *S. Crameri* in Wolle, Bull. Torr. Club 6: 185 (1877), F. W. Alg. 272 (1887); as *Stigonema ocellatum* in Setchell, Erythea 7: 48 (1899), in Tilden, Minn. Alg. 1: 247 (1910).

STIGONEMA HORMOIDES (Kütz.) Born. & Flah., ibid. 5: 68 (1887). *Sommierella hormoides* Borzi, N. Giorn. Bot. Ital., N. S. 24: 79 (1917). —Specimens seen: PENNSYLVANIA: with *Stigonema informe*, wet rocks, 1878 (N, U); 'Scytonema callitrichoides' (D, P).

References: as *Sirosiphon compactus* in Wolle, F. W. Alg. 271 (1887) in part; as *Stigonema hormoides* in Setchell, Erythea 7: 47 (1899).

FISCHERELLA THERMALIS (Born. & Flah.) Gom., Journ. de Bot. 9: 52 (1895). *Stigonema thermale* (Schwabe) Borzi ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 66 (1887).—Specimens seen: NEW JERSEY: rotten wood, *Austin* (P). FLORIDA: *Smith*, Mar. 1878 (P, U). TEXAS: on damp fallen logs, Houston, *Ravenel 21* (P).

Reference: as *Hapalosiphon Braunii* in Wolle, F. W. Alg. 275 (1887) in part.

FISCHERELLA AMBIGUA (Born. & Flah.) Gom., loc. cit. (1895). *Scytonema ambiguum* Kütz. ex Born. & Flah., ibid. 5: 100 (1887). *S. badium* Wolle ex Born. & Flah. sp. inquir., ibid. 5: 111 (1887); Wolle, Bull. Torr. Club 6: 184 (1877). *Phormidium interruptum* var. *rigidum* Gardn., Mem. New York Bot. Gard. 7: 44 (1927).—The well preserved original material of *Scytonema badium* is similar to specimens of *Fischerella ambigua* treated by Gomont. Specimens seen: NEW YORK: Herkimer County, *Austin*, 1868 (TYPE of *Scytonema*

[1] Isotypic material of *S. anomalum* distributed in Phyc. Bor.-Amer. 1952, MASSACHUSETTS: Chebacco Pond, Essex, *F. D. Lambert*, Oct. 1909 (F, FM, N), appears to me to represent a growth form of *S. ocellatum* with well developed narrow branches and hyaline sheaths; in older parts of the same masses, the filaments are similar in every respect to those of other specimens of *S. ocellatum*.

badium, P). SOUTH CAROLINA: with *Schizothrix arenaria* on ground, Aiken, *Ravenel 254* (F), *502* (PW).

References: as *Scytonema badium* in Forti, Syll. Myxophyc. 524 (1907), in Tilden, Minn. Alg. 1: 225 (1910), in Geitler, Rabenh. Krypt-Fl. 14: 786 (1932).

FISCHERELLA MAJOR Gom., Journ. de Bot. 16: 299 (1902).—The few specimens are similar to the material (presumably isotypic) distributed in Mus. Vindob. Krypt. Exs. 333 (N). They are: SOUTH CAROLINA: earth, Aiken, *Ravenel 102* (BM), *143* (BM, F); granite walls, Aiken, *Ravenel 498*, Nov. 1883 (PW).

Reference: as *Symploca lucifuga* in Wolle, F. W. Alg. 303 (1887) in part.

HAPALOSIPHON PUMILUS (Kütz.) Kirchn. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 61 (1887). *H. fontinalis* (Ag.) Born., Bull. Soc. Bot. France 36: 156 (1889). *H. brasiliensis* Borge, Ark. f. Bot. 15 (13): 94 (1919).—Specimens seen: NEW JERSEY: Swartwood Lake, 1879 (D, P); Bamber, Ocean County (P); Hammerton Pond, Aug. 1879 (P; Wittr. & Nordst., Alg. exs. 390, N. PW, U); Absecon, July 1878 (D, P). PENNSYLVANIA: with *Porphyrosiphon Notarisii* as 'Hydrocoleum heterotrichum' (P); 'Hapalosiphon Braunii' (U). SOUTH CAROLINA: in pools of water, Aiken, *Ravenel*, Feb. 1878 (P), *470*, Nov. 1883 (PW).

References: as *H. Braunii* in Wolle, Bull. Torr. Club 6: 285 (1879), Wittr. & Nordst. Alg. exs. 8: 390 (1880), F. W. Alg. 275 (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889), in part; as *H. fuscescens* of Wolle, Bull. Torr. Club 6: 285 (1879), F. W. Alg. 277 (1885), Britton Final Rep. Geol. N. J. 2: 606 (1889); as *H. fontinalis* in Tilden, Minn. Alg. 1: 239 (1910).

Nostocaceae

NOSTOC PISCINALE Kütz. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 7: 194 (1888).—Specimens seen: PENNSYLVANIA: pool, Aug. 1876 (F); canal below Nisky (N); pool near Bethlehem (P, U); 'N. lacustre–comminutum' (D, P).

References: as *N. comminutum* in Wolle, F. W. Alg. 282 (1887) in part, in Tilden, Minn. Alg. 1: 165 (1910) in part.

NOSTOC RIVULARE Kütz. ex Born. & Flah., ibid. 7: 195 (1888).—Specimens seen: GEORGIA: still water, Darien, *Ravenel 445*, Nov. 1881 (F). FLORIDA: *Smith*, 1878 (P, U).

References: as *N. comminutum* in Wolle, loc. cit. (1887) in part, in Tilden, loc. cit. (1910) in part; as *Cylindrospermum flexuosum* in Wolle, ibid. 292 (1887) in part.

NOSTOC COMMUNE Vauch. ex Born. & Flah., ibid. 7: 203 (1888).—Specimens seen: NEW YORK: Portage, 1876 (P); on moss, Niagara, 1876 (P). NEW JERSEY: rocks, *Austin* (P); Closter, 1863 (P). PENN-

SYLVANIA: in consortis *Scytonem. Myochr.* (Wittr. & Nordst., Alg. exs. 890, N, PW); Rockdale, 1863 (P). FLORIDA: *Smith*, Mar. 1878 (U). MONTANA: *F. W. Anderson*, 1886 (PW). COLORADO: on water, on moist ground, *Brandegee*, 1877 (P); on Grimmia, *Austin*[1] (U); May 1877 (N).

References: as *N. Muscorum* in Wolle, Bull. Torr. Club 6: 283 (1879), F. W. Alg. 282 (1887), in Tilden, Minn. Alg. 1: 169 (1910); as *N. comminutum* in Wolle, loc. cit. (1887) in part; as *N. humifusum* in Wolle, loc. cit. (1887), in Tilden, ibid. 170 (1910); as *N. commune* in Wolle, F. W. Alg. 283 (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889), Wittr. & Nordst. Alg. exs. 18: 890 (1890), in Tilden, ibid. 171 (1910); as *N. sphaericum* in Wolle, F. W. Alg. 283 (1887) in part, in Tilden, ibid. 173 (1910) in part; as *N. caeruleum* of Wolle, ibid. 284 (1887), in Tilden, ibid. 177 (1910).

NOSTOC COMMUNE var. FLAGELLIFORME (Berk. & Curt.) Born. & Flah., ibid. 7: 206 (1888).—The Texas collection is of the same material as that distributed by Farlow, Anderson & Eaton in Alg. Am. Bor. Exs. 100. Specimens seen: KANSAS: on red clay soil, Barbour County, *F. W. Cregin*, 1888 (D, P). TEXAS: *C. Wright* (FM, P).

References: as *N. flagelliforme* in Wolle, F. W. Alg. 285 (1887); as *N. commune* var. *flagelliforme* in Tilden, Minn. Alg. 1: 173 (1910).

NOSTOC MICROSCOPICUM Carm. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 7: 210 (1888).—Specimens seen: PENNSYLVANIA: wet rocks (D, P); Pike County (D, P).

References: as *N. riparium* in Wolle, Bull. Torr. Club 6: 217 (1878) in part; as *N. sphaericum* in Wolle, F. W. Alg. 283 (1887) in part, in Tilden, Minn. Alg. 1: 173 (1910) in part.

NOSTOC CAERULEUM Lyngb. ex Born. & Flah., ibid. 7: 213 (1888). —One specimen: MINNESOTA: Lake of the Isles, Minneapolis, *E. Butler*, 1883 (PW).

NOSTOC PRUNIFORME (L.) Ag. ex Born. & Flah., ibid. 7: 215 (1888).—Specimens seen: NEW JERSEY: in rivulets, Closter, *Austin* (P), 1870 (P), 1877 (P); 'N. cristatum–riparium' (P). PENNSYLVANIA: 'N. pruniforme' (B, O, P, U); river stones (O, P); canal below Nisky (N); pool near Bethlehem, Aug. 1878 (P, U); in stagnis, Bethlehem, 1877 (Rabenh. Alg. 2530, N); meadow pools (D, O, P, U); rock pool, Nisky (N); near Brofuss Lock, Aug. 1877 (N).

References: as *N. cristatum* in Wolle, Bull. Torr. Club 6: 183 (1877); as *N. riparium* in Wolle, loc. cit. (1877) in part; as *N. pruniforme* in Wolle, loc. cit. (1877), Rabenh. Alg. 2530 (1878), F. W. Alg. 284 (1887), in Tilden, Minn. Alg. 1: 178 (1910); as *N. sphaericum* in Wolle, ibid. (1887) in part, in Tilden, ibid. 173 (1910) in part; as *N. alpinum* in Wolle, ibid. 285 in part (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889); as *N. parmelioides* in Tilden, ibid. 181 (1910) in part.

[1] This label is in Capt. Smith's handwriting. The collection is more probably one by T. S. Brandegee than one by C. F. Austin.

NOSTOC VERRUCOSUM (L.) Vauch. ex Born. & Flah., ibid. 7: 216 (1888).—Specimens seen: PENNSYLVANIA: Skinner's Spring, July 1877 (D, N, O, P); 'N. alpinum' (F, P); Derry Church, Dauphin County, Oct. 1887 (PW).

References: as *N. verrucosum* in Wolle, F. W. Alg. 284 (1887), in Tilden, Minn. Alg. 1: 179 (1910); as *N. alpinum* in Wolle, ibid. 285 (1887) in part.

NOSTOC PARMELIOIDES Kütz. ex Born. & Flah., ibid. 219 (1888).—One specimen: PENNSYLVANIA: Monocasy's Spring, 1877 (N).

References: as *N. alpinum* in Wolle, F. W. Alg. 285 (1887) in part; as *N. parmelioides* in Tilden, Minn. Alg. 1: 181 (1910) in part.

NOSTOC sp.—One ill-preserved specimen: CALIFORNIA: on Cladophora (P).

References: as *N. glomeratum* in Wolle, Bull. Torr. Club 6: 183 (1877), in Tilden, Minn. Alg. 1: 177 (1910).

WOLLEA SACCATA (Wolle) Born. & Flah., Ann. Sci. Nat. VII Bot. 7: 223 (1888). *Sphaerozyga saccata* Wolle ex Born. & Flah. pro. synon., loc. cit. (1888); Wolle, Bull. Torr. Club 7: 44 (1880).—The spores in the collections are by no means mature. Specimens seen: NEW JERSEY: cranberry pond, Waterloo, 1879 (ISOTYPE, P); pond (O); in aqua stagnante, July 1879 (ISOTYPE in Wittr. & Nordst., Alg. exs. 397, N, PW).

References: as *Sphaerozyga saccata* in Wolle, Wittr. & Nordst. Alg. exs. 8: 397 (1880), F. W. Alg. 290 (1887); as *Wollea saccata* in Wolle, Britton Final Rep. Geol. N. J. 2: 607 (1889), in Tilden, Minn. Alg. 1: 181 (1910).

ANABAENA CIRCINALIS (Kütz.) Rabenh. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 7: 230 (1888). *Microcystis lobata* Dickie, Journ. Linn. Soc. Bot. 18: 128 (1880). *Anabaena scabra* Dickie ex Born. & Flah. sp. inquir., ibid. 7: 239 (1888).—One specimen: MINNESOTA: Minneapolis, *E. Butler*, Oct. 1882 (P).

References: as *A. circinalis* in Wolle, Bull. Torr. Club 10: 21 (1883), in Tilden, ibid. 190 (1910); as *A. flos-aquae* var. *circinalis* in Wolle, F. W. Alg. 287 (1887).

ANABAENA CATENULA (Kütz.) Born. & Flah., ibid. 7: 232 (1888).—One collection: MINNESOTA: Lake Stay, *E. Doolittle*, 1888 (PW).

ANABAENA OSCILLARIOIDES Bory ex Born. & Flah., ibid. 7: 233 (1888).—Specimens seen: PENNSYLVANIA: 'Cylindrospermum flexuosum' (D, P). GEORGIA: salt marsh mud flats, Darien, *Ravenel 311* (F). MONTANA: Helena, *F. D. Kelsey*, 1889 (PW); Oro Fino Gulch near Helena, *F. W. Anderson 43*, June 1887 (PW).

References: as *Cylindrospermum limicola* in Wolle, F. W. Alg. 292 (1887) in part; as *C. flexuosum* in Wolle, loc. cit. (1887) in part; as *Anabaena oscillarioides* in Tilden, Minn. Alg. 1: 193 (1910) in part.

ANABAENA spp.?—These specimens appear to represent species of Anabaena but are in a sporeless or otherwise unrecognizable state: PENNSYLVANIA: 'Limnochilde' (P). SOUTH CAROLINA: *Smith*, Mar. 1878 (P).

References: as *Aphanizomenon flos-aquae* in Wolle, F. W. Alg. 291 (1887), in Tilden, Minn. Alg. 1: 196 (1910); as *Cylindrospermum limicola* in Wolle, ibid. 292 (1887) in part.

CYLINDROSPERMUM MAJUS Kütz. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 7: 252 (1888). *C. janthinum* Dickie ex Born. & Flah. sp. inquir., ibid. 7: 255 (1888).—The material labeled 'Phormidium congestum' by Wolle is a mixture of *C. majus* and several terrestrial species of Schizothrix and Microcoleus, each varying in abundance in specimens represented in several herbaria. There is evidence that the collection was made on Wolle's trip to Niagara Falls in August, 1876. Specimens seen: NEW YORK: 'Phormidium congestum', sandy deposit, Aug. 1876 (P). PENNSYLVANIA: wet wood (D, N, P, U); 'Cylindrospermum macrospermum' (O). MARYLAND: rocks, Baltimore County, *Smith*, May 1878 (P, U). SOUTH CAROLINA: *Smith*, Mar. 1878 (U); standing pools, Aiken, *Ravenel*, Oct. 1883 (PW).

References: as *Phormidium congestum* in Wolle, Bull. Torr. Club 6: 138 (1877) in part, in Tilden, Minn. Alg. 1: 118 (1910) in part; as *Cylindrospermum macrospermum* in Wolle, F. W. Alg. 292 (1887) in part; as *C. limicola* in Wolle, loc. cit. (1887) in part; as *C. stagnale* in Tilden, ibid. 198 (1910) in part; as *C. majus* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 6 (1939).

CYLINDROSPERMUM LICHENIFORME (Bory) Kütz. ex Born. & Flah., ibid. 7: 253 (1888).—Specimens seen: FLORIDA: Mar. 1878 (P); southwestern Florida, *Smith*, Mar. 1878 (U).

References: as *C. macrospermum* in Wolle, F. W. Alg. 292 (1887) in part; as *C. stagnale* in Tilden, Minn. Alg. 1: 198 (1910) in part.

CYLINDROSPERMUM MUSCICOLA Kütz. ex Born. & Flah., ibid. 7: 254 (1888). *C. caeruleum* Dickie ex Born. & Flah., sp. inquir., ibid. 7: 255 (1888).—Specimens seen: GEORGIA: salt water mud flats, Darien, *Ravenel*, Apr. 1878 (P). FLORIDA: *Smith*, Mar. 1878 (D, P, U).

Rivulariaceae

AMPHITHRIX JANTHINA (Mont.) Born. & Flah., Ann. Sci. Nat. VII Bot. 3: 344 (1886).—Specimens seen: PENNSYLVANIA: on stones in spring water (D, P, U); 'Mastigonema caespitosum' (P).

References: as *Mastigonema caespitosum* in Wolle, Bull. Torr. Club 6: 138 (1877) in part; as *Isactis caespitosa* in Wolle, F. W. Alg. 245 (1887) in part; as *Leptothrix caespitosa* in Wolle, ibid. 320 (1887) in part; as *Calothrix parietina* in Tilden, Minn. Alg. 1: 269 (1910) in part.

CALOTHRIX JULIANA (Menegh.) Born. & Flah., ibid. 3: (1886).—One collection: PENNSYLVANIA: 'Geocyclus oscillarinus', river stones (D, N, P).

CALOTHRIX PULVINATA (Mert.) Ag. ex Born. & Flah., ibid. 3: 356 (1886). *Mastigonema velutinum* Wolle ex Born. & Flah., ibid. 5: 94 (1887), as to Wolle's specimens described and distributed, not as to the TYPE in Herb. Bornet interpreted by Bornet & Flahault?; Wolle, Bull. Torr. Club 6: 283 (1879).—Wolle's *M. velutinum* was described and later distributed in Wittr. & Nordst., Alg. exs. 388, as a plant of salt water. Bornet & Flahault, however, have placed the name as a synonym of the strictly non-marine *Scytonema guyanense*. Moreover, these authors have cited this same published isotypic material in their treatment of *Calothrix scopulorum* Born. & Flah., ibid. 3: 353 (1886). To dispose of the name *Mastigonema velutinum* properly we must await a reinterpretation of the specimen designated as the TYPE ('specim. auth.') in Bornet's herbarium. Specimens seen: NEW JERSEY: on wood, submarine, 1878 (original material of *M. velutinum*, N, P, U); Perth Amboy, July 1878 (Wittr. & Nordst., Alg. exs. 388, N, PW). GEORGIA: salt water creeks, Darien, *Ravenel*, Apr. 1878 (P), *308* (BM).

References: as *M. velutinum* in Wolle, Wittr. & Nordst. Alg. exs. 8: 388 (1880); as *M. aerugineum* in Wolle, F. W. Alg. 241 (1887), Britton Final Rep. Geol. N. J. 2: 603 (1889).

CALOTHRIX PARIETINA (Näg.) Thur. ex Born. & Flah., ibid. 3: 366 (1886). *Mastigothrix turgida* Wolle ex Forti, Syll. Myxophyc. 632 (1907); Wolle, Bull. Torr. Club 6: 184 (1877).—Specimens seen: MASSACHUSETTS: on stones, Woods Hole, *W. G. Farlow*, Aug. 1876 (P). NEW YORK: old boards, Niagara, Aug. 1876 (P). PENNSYLVANIA 'Pilinia diluta' (D, P); 'Mastigothrix turgida, n. sp.' (TYPE of *Mastigothrix turgida*, P; isotype, D); stones in limestone springs (D, P). FLORIDA: 'Mastigonema pluviale', Mar. 1878 (P).

References: as *Calothrix crustacea* in Wolle, F. W. Alg. 239 (1887); as *C. parietina* in Setchell, Erythea 7: 45 (1899); as *Mastigothrix turgida* in Tilden, Minn. Alg. 1: 273 (1910).

CALOTHRIX BRAUNII Born. & Flah., ibid. 3: 368 (1886). *Inactis obscura* Dickie ex Gom. sp. excl., Ann. Sci. nat. VII Bot. 15: 329 (1892); Dickie, Journ. Linn. Soc. Bot. 18: 126 (1880); Drouet, Amer. Journ. Bot. 25: 660 (1938).—Specimens seen: PENNSYLVANIA: large spring, Nazareth, July 1887 (D, PW); Derry Church, Dauphin County, Oct. 1887 (PW).

Reference: as *Isactis caespitosa* in Wolle, F. W. Alg. 244 (1877) in part.

CALOTHRIX ADSCENDENS (Näg.) Thur. ex Born. & Flah., ibid. 3: 365 (1886). *C. violacea* (Wolle) Forti, Syll. Myxophyc. 619 (1907). *Mastigonema violaceum* Wolle ex Forti pro. synon., loc. cit. (1907); Wolle, Bull. Torr. Club 6: 138 (1877). *M. fuscum* Wolle ex Forti, ibid. 618 (1907); Wolle, loc. cit. (1877). *Calothrix Fortii* J. DeToni, Noter. Nomencl. Algol. 1: 6 (1934).—Specimens seen: PENNSYLVANIA: parasitic on *Lyngbya Wollei* and Cladophora (TYPES of *Calothrix violacea* and *Mastigonema fuscum*, P; isotypes, D, F).

References: as *Leptothrix parasitica* in Wolle, Bull. Torr. Club 6: 182 (1877); as *Calothrix adscendens* in Setchell, Erythea 7: 46 (1899), in Tilden, Minn. Alg. 1: 267 (1910); as *C. violacea* in Tilden, loc. cit. (1910); as *C. fusca* in Tilden, ibid. 265 (1910).

DICHOTHRIX HOSFORDII (Wolle) Born. apud Setchell, Erythea 4: 190 (1896). *Calothrix Hosfordii* Wolle ex Born. & Flah. sp. inquir., Ann. Sci. Nat. VII Bot. 3: 370 (1886); Wolle, Bull. Torr. Club 8: 38 (1881).—The specimen from Vermont is annotated by C. G. Pringle, fellow collector of F. H. Hosford to whom Wolle ascribes the original collection. The mass is scanty and poorly developed; the filaments are very young, but they match well young filaments in specimens distributed as *D. Hosfordii* by Prof. Setchell. The specimen from New York is a duplicate of that upon which Bornet and Setchell based the binomial *D. Hosfordii*, and which is mentioned by Setchell in Phyc. Bor.-Amer. 5: 215 (1896) as having been "referred to Calothrix Hosfordii by Mr. Wolle himself." Specimens seen: VERMONT: wet rocks, La Plata River, Charlotte (F). NEW YORK: on submerged stones, Lake George, *S. E. Jeliffe*, Oct. 1892 (N).

References: as *Calothrix Hosfordii* in Wolle, F. W. Alg. 239 (1887); as *Dichothrix Hosfordii* in Forti, Syll. Myxophyc. 640 (1907), in Tilden, Minn. Alg. 1: 278 (1910).

DICHOTHRIX BAUERIANA (Grun.) Born & Flah., ibid. 3: 375 (1886).—Specimens seen: NEW JERSEY: Morris Pond, July 1879 (Wittr. & Nordst., Alg. exs. 389, N, PW). PENNSYLVANIA: 'Calothrix radiosa' (P). FLORIDA: *Smith*, Mar. 1878 (P, U). TERRITORY OF HAWAII: from rockery, Wailuku, *Hitchcock*, July 1881 (U).

References: as *Schizosiphon Bauerianus* in Wolle, Bull. Torr. Club 6: 284 (1879); as *Calothrix Orsiniana* in Wolle, Wittr. & Nordst. Alg. exs. 8: 389 (1880), Bull. Torr. Club. 8: 38 (1881); as *C. radiosa* var. *fuscescens* in Wolle, loc. cit. (1881); as *C. affinis* in Wolle, ibid. 9: 25 (1882); as *C. radiosa* in Wolle, F. W. Alg. 238 (1887), Britton Final Rep. Geol. N. J. 2: 603 (1889); as *Dichothrix Baueriana* in Tilden, Minn. Alg. 1: 276 (1910).

DICHOTHRIX ORSINIANA (Kütz.) Born. & Flah., Ann. Sci. Nat. VII Bot. 3: 376 (1886).—One collection: NEW YORK: Niagara, Aug. 1876 (F, P).

References: as *Mastigonema Orsinianum* in Wolle, Bull. Torr. Club 6: 138 (1877); as *Dichothrix Orsiniana* in Tilden, Minn. Alg. 1: 275 (1910) in part.

RIVULARIA HAEMATITES (DC.) Ag. ex Born. & Flah., ibid. 4: 350 (1886).—The specimens cited here from the Farlow Herbarium were annotated by Bornet in 1899 as the marine and brackish-water species *R. Biasolettiana* Menegh. ex Born. & Flah. One collection: NEW YORK: Niagara, Aug. 1876 (F, P).

Reference: as *Zonotrichia chrysocoma* in Wolle, Bull. Torr. Club 6: 138 (1877).

GLOEOTRICHIA ECHINULATA (Born. & Flah.) Richt., Forschungsber. Biol. Sta. Plön 2: 32 (1894). *Rivularia echinulata* Engl. Bot. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 4: 366 (1886).—Many papers have been written concerning why we should or should not consider *Gloeotrichia echinulata* and *G. Pisum* as distinct species; the earlier literature is reviewed by Bornet & Flahault in Bull. Soc. Bot. France 31: 76–81 (1884), by Richter (ibid.), by Howe in Torreya 3: 150–154 (1903), and by others. Bornet & Flahault's work alone is based upon a comparative study of collections from many widely separated localities; these authors placed the two forms together under the name *G. Pisum*. The numerous other papers which have come to my attention contain, aside from the customary meticulous review of literature, no more than lengthy dissertations upon the morphology of the plants as they appear in water-blooms on local ponds and lakes. Intimate details of the life history of each form are still lacking. In recent studies I have had access to scarcely a hundred different collections of the two forms, living and preserved, from many parts of the world, including those seen by Bornet & Flahault, Richter, Howe, and others. At present I can find no sound morphological or ecological basis upon which to separate the two as distinct species. I retain the two names here only as a matter of convenience to indicate, as Bornet & Flahault have already suggested, what may be two extremes of habitat and growth relationship: *G. echinulata* the small form, usually planktonic, and *G. Pisum* the small or large form, known to be attached to a substratum in the juvenile state and later floating free in the water.

Wolle's notes on *Rivularia radians* var. *minutula* in Bull. Torr. Club 8: 38 (1881) should give us little doubt that he referred here to *Gloeotrichia echinulata*. However, this report is the basis of Tilden's inclusion (Minn. Alg. 1: 288) of *Rivularia minutula* (Kütz.) Born. &

Flah. in the North American flora. Specimens seen: MINNESOTA: floating in the lake, Waterville, *J. C. Arthur*, July 1882 (F), Aug. 1882 (F).

References: as *Rivularia echinulata* in Wolle, F. W. Alg. 249 (1887), in Tilden, Minn. Alg. 1: 291 (1910).

GLOEOTRICHIA PISUM (Ag.) Thur. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 4: 366 (1886). *Rivularia Pisum* Ag. ex Born. & Flah. pro. synon., loc. cit. (1886). *R. paradoxa* (Wolle) Forti, Syll. Myxophyc. 672 (1907). *Zonotrichia paradoxa* Wolle ex Forti, ibid. 636 (1907); Wolle, Bull. Torr. Club 6: 138 (1877).—In the original material of *Z. paradoxa* most of the vegetative cells have disappeared from the plants, but the remaining spores are very typical of *Gloeotrichia Pisum*. Specimens seen: PENNSYLVANIA: culms of Sagittaria (TYPE of *Zonotrichia paradoxa*, P; isotypes, N, U); 'Gloeotrichia–Rivularia' (P). MONTANA: Grand Coulee Creek, *F. W. Anderson*, Sept. 1889 (PW).

References: as *Zonotrichia paradoxa* in Wolle, Bull. Torr. Club 6: 184 (1877); as *Rivularia paradoxa* in Tilden, Minn. Alg. 1: 289 (1910).

GLOEOTRICHIA NATANS (Hedw.) Rabenh. ex Born. & Flah., ibid. 4: 369 (1886). *Rivularia natans* (Hedw.) Welw. ex Born. & Flah. pro. synon., loc. cit. (1886). *Calothrix scytonemicola* var. *brasiliensis* Borge, Ark. f. Bot. 19 (17): 5 (1925). *Rivularia* (*Gloeotrichia*) *flagelliformis* Gardn., Mem. New York Bot. Gard. 7: 71 (1927).—Specimens seen: NEW YORK: ponds, Buffalo, Aug. 1876 (D, F, N, P, U). PENNSYLVANIA: culms in stagnant water (D, P); an Halmen von Wasserpflanzen und Sagittaria, Bethlehem, July 1877 (Rabenh. Alg. 2539, N, T). SOUTH CAROLINA: Santee Canal, *Ravenel* (BM).

References: as *G. natans* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 246 (1877); as *G. Pisum* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 247 (1887); as *G. parvula* in Wolle, Rabenh. Alg. 2539 (1878); as *Rivularia Pisum* in Tilden, Minn. Alg. 1: 284 (1910) in part; as *R. natans* in Tilden, ibid. 285 (1910).

Scytonemataceae

FREMYELLA **diplosiphon** (Born. & Flah.), **comb. nov.** *Microchaete diplosiphon* Gom. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 84 (1887); Gomont, Bull. Soc. Bot. France 32: 211 (1885).—J. DeToni in Noter. Nomencl. Algol. VIII (1936) has pointed out that the generic name Michrochaete was used to designate certain phanerogamous plants before it was proposed for a similar group of Myxophyceae. One collection: PENNSYLVANIA: pump trough (D, P).

References: as *Mastigonema paradoxum* in Wolle, Bull. Torr. Club 6: 184 (1877), in Tilden, Minn. Alg. 1: 273 (1910).

TOLYPOTHRIX LANATA (Desv.) Wartm. ex Born. & Flah., ibid. 5: 120 (1887). *T. bombycina* Wolle sp. nov., Bull. Torr. Club 7: 44 (1880).—Specimens seen: NEW JERSEY: Lake Hopatcong, 1879 (TYPE of *T. bombycina*, P; isotype, D). PENNSYLVANIA: on Conomitrium, July 1876 (F, P); with *Gloeotrichia Pisum* on culms of Sagittaria (P); stagnant water, Sept. 1878 (U); 'Calothrix mirabilis' (U).

References: as *T. muscicola* in Wolle, Bull. Torr. Club 6: 139 (1877), F. W. Alg. 264 (1887) in part; as *Plectonema mirabile* in Wolle, ibid. 266 (1887) in part; as *Tolypothrix lanata* in Tilden, Minn. Alg. 1: 230 (1910) in part.

TOLYPOTHRIX TENUIS Kütz. ex Born. & Flah., ibid. 5: 122 (1887). *T. rupestris* Wolle, F. W. Alg. 265 (1887), Bull. Torr. Club 6: 185 (1877); Geitler, Rabenh. Krypt.-Fl. 14: 733 (1932).—As Prof. Setchell has already pointed out in Erythea 4: 193 (1896) the original material of *T. rupestris* cannot be separated from other specimens of *T. tenuis*. Geitler (ibid.) has shown that a few of the filaments are broader than is usual in *T. tenuis*; it appears to me that the method of preparation of the specimens is responsible for such anomalies. The habit of the filaments in the masses bears little resemblance to that of species of Hassallia with which Geitler has placed *T. rupestris*. Setchell (ibid.) has referred part of Wolle's *T. muscicola* to *T. tenuis*. Specimens seen: MASSACHUSETTS: Woods Hole, *W. G. Farlow* (P). NEW JERSEY: 'T. Aegagropila' (N). PENNSYLVANIA: Delaware Water Gap, July 1878 (TYPE of *T. rupestris*, P; isotypes, D, N, O, U); in rupibus madore continuo irroratis, Delaware Water Gap, July 1879 (Rabenh. Alg. 2573, N); 'T. Aegagropila' (D, N, O, P); beech woods, July 1878 (D, P); 'Lehigh also Hopedale' (N).

References: as *T. Bulnheimii* in Wolle, Bull. Torr. Club 6: 185 (1877); as *T. rupestris* in Wolle, Rabenh. Alg. 2573 (1879), in Tilden, Minn. Alg. 1: 234 (1910); as *T. Aegagropila* in Wolle, Bull. Torr. Club 7: 44 (1880), F. W. Alg. 263 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *T. tenuis* in Setchell, loc. cit. (1896).

HASSALLIA BYSSOIDEA (Berk.) Hass. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 116 (1887). *Anabaena cupressaphila* Wolle ex Forti, Syll. Myxophyc. 456 (1907); Wolle, F. W. Alg. 288 (1887). *Tolypothrix byssoidea* Kirchn. ex Forti, Syll. Myxophyc. 561 (1907); Kirchn. (the name ineffectively published), Schizophyc. 80 (1900). *Scytonema* (*Petalonema*) *junipericola* Farlow,[1] Phyc. Bor.-Amer. 16: 756.

[1] The original material of this species, BERMUDA: 'Fairyland', *W. G. Farlow*, Jan. 1900 (TYPE, F; isotypes in Phyc. Bor.-Amer. 756, D, FM, N, T), is to be recognized at once as *Hassallia byssoidea*. In parts of the masses, the filaments have the usual aspect of this species; in other parts, the sheaths are somewhat gelatinized and the divergent lamellation is conspicuous. Geitler, Rabenh. Krypt.-Fl. 14: 797 (1932), has suggested that *Scytonema junipericola* is related to *S. mirabile* Born. (*S. figuratum* of this paper); a glance at material of the two, however, should show that such an idea is untenable.

(1900).—The TYPE of *Anabaena cupressaphila* is a mass of hormogonia of *Hassallia byssoidea*. Here also belongs, possibly, Wolle's report of *Hapalosiphon byssoideus* in F. W. Alg. 276. Specimens seen: NEW JERSEY: on red cedar, Closter (TYPE of *Anabaena cupressaphila*, P). PENNSYLVANIA: old wood, wet places (D, P); moist log at canal lock (P). SOUTH CAROLINA: on Nyssa, Aiken, *Ravenel 137* (F); on old pine board, Aiken, *Ravenel 201, 334* (F, P); trunks of trees, Aiken, *Ravenel* (N). GEORGIA: on pine boards and on Juniperus, *Ravenel 387, 404* (F). TEXAS: trunks of trees, Houston, *Ravenel* (N).

References: as *Trichormus incurvus* in Wolle, Bull. Torr. Club 6: 183 (1877); as *Scytonema truncicola* in Wolle, ibid. 6: 284 (1879), Amer. Quart. Microsc. Journ. 1: 207 (1879); as *S. cortex* f. *Ravenelii* in Wolle, F. W. Alg. 257 (1887) as to specimens, not as to name-bearing synonym?; as *Tolypothrix truncicola* in Wolle, ibid. 266 (1887); as *Sirosiphon lignicola* in Wolle, ibid. 273 (1887) in part; as *Anabaena cupressaphila* in Wolle, Britton Final Rep. Geol. N. J. 2: 607 (1889), in Tilden, Minn. Alg. 1: 195 (1910); as *A. flos-aquae* in Tilden, ibid. 189 (1910) in part; as *Tolypothrix byssoidea* in Tilden, ibid. 233 (1910).

DIPLOCOLON HEPPII Näg. ex Born. & Flah., ibid. 5: 129 (1887). *Scytonema Heppii* Wolle ex Forti pro. synon., Syll. Myxophyc. 561 (1907); Wolle, F. W. Alg. 260 (1887), as to name-bearing synonym, not as to specimens.—Kossinskaja, Not. Syst. Crypt. Hort. Bot. Princip. URSS 4: 64–74 (1926), has endeavored to show that this species is really a growth form of *Scytonema crustaceum* var. *incrustans*. It is unfortunate that in making observations this author did not study also Hepp's isotypic specimens distributed in Rabenh. Alg. 468 and material of *S. crustaceum* cited by Bornet & Flahault. In the specimens treated by the monographers and those cited in the present paper, I am given the impression that the scytonematoid filaments of the two species are easily distinguished by the nature of the lamellation of the sheaths, as indicated in Bornet & Flahault's descriptions. It would be hazardous to suggest a union of the two species, as both Kossinskaja (ibid.) and Geitler, Rabenh. Krypt.-Fl. 14: 782 (1932), have done, at least upon the basis of the few collections now on file in herbaria. Specimens seen: NEW YORK: Niagara, Aug. 1876 (F, P).

References: as *Diplocolon Heppii* in Wolle, Bull. Torr. Club 6: 139 (1877), in Setchell, Erythea 4: 193 (1896), in Tilden, Minn. Alg. 1: 236 (1910) in part, in Smith, Freshw. Alg. U. S. 97 (1933) in part.

SCYTONEMA ALATUM (Berk.) Borzi ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 110 (1887). *Petalonema alatum* Berk. ex Born. & Flah. pro. synon., loc. cit. (1887).—Specimens seen: NEW YORK: Niagara, Aug. 1876 (F, P).

References: as *Scytonema alatum* in Setchell, Erythea 4: 193 (1896), in Tilden, Minn. Alg. 1: 225 (1910); as *Petalonema alatum* in Wolle, F. W. Alg. 267 (1887).

SCYTONEMA DENSUM (A. Br.) Born. & Flah., ibid. 5: 109 (1887). *S. evanescens* Gardn.,[1] Mem. New York Bot. Gard. 7: 71 (1927). *Petalonema densum* Mig. ex Geitler, Rabenh. Krypt.-Fl. 14: 793 (1932).—Specimens seen: NEW YORK: wet moss and wood, old boards, Niagara, Aug. 1876 (F, P).

References: as *Scytonema tolypotrichoides* in Wolle, Bull. Torr. Club 6: 139 (1877) in part, F. W. Alg. 250 (1887); as *Symphyosiphon incrustans* in Wolle, Bull. Torr. Club 6: 139 (1877) in part; as *S. Contarenii* in Wolle, loc. cit. (1877); as *Scytonema densum* in Setchell, Erythea 4: 191 (1896), in Tilden, Minn. Alg. 1: 227 (1910).

SCYTONEMA CRUSTACEUM (Ag.) Born. & Flah., ibid. 5: 106 (1887). *S. crustaceum* var. *incrustans* (Kütz.) Born. & Flah., ibid. 5: 107 (1887). *S. mirabile* Wolle, F. W. Alg. 255 (1887), Bull. Torr. Club 6: 217 (1878), ibid. 6: 384 (1879), not Born. *S. Wolleanum* Forti, Syll. Myxophyc. 513 (1907). *Petalonema crustaceum* Kirchn. ex Forti pro. synon., ibid. 525 (1907); Kirchner (the name ineffectively published), Schizophyc. 79 (1900).—Bornet & Flahault (ibid.) must have made a typographical error in placing Wolle's report of *Symphyosiphon incrustans* instead of his *Scytonema mirabile* in synonymy with their *S. crustaceum* var. *incrustans*. Setchell in Erythea 4: 191 (1896) pointed out this error long before Forti proposed the superfluous name *S. Wolleanum* for *S. mirabile* Wolle instead of for its later homonym, *S. mirabile* (Dillw.) Born. (see *S. figuratum* of this paper). Specimens seen: SOUTH CAROLINA: Aiken, *Ravenel 109, 351* (F). FLORIDA: Gainesville, *Ravenel* (TYPE of *S. mirabile* Wolle, P; isotype, F); *Smith*, Mar. 1878 (P, U).

References: as *Schizosiphon cataractae* in Wolle, Bull. Torr. Club 6: 284 (1879); as *Scytonema Heppii* in Wolle, F. W. Alg. 260 (1887); as *S. crustaceum* var. *incrustans* in Setchell, loc. cit. (1896), in Tilden, Minn. Alg. 1: 226 (1910); as *S. Wolleanum* in Tilden, ibid. 221 (1910), in Geitler, Rabenh. Krypt.-Fl. 14: 787 (1932); as *Diplocolon Heppii* in Tilden, ibid. 236 (1910) in part, in Smith, Freshw. Alg. U. S. 97 (1933) in part.

SCYTONEMA MYOCHROUS (Dillw.) Ag. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 104 (1887). *S. cataracta* Wood ex Born. & Flah. pro. synon., ibid. 5: 105 (1887); Wood, Proc. Amer. Philos. Soc. 11: 129 (1869). *S. Brandegeei* Wolle ex Born. & Flah. sp. inquir., ibid. 5: 111 (1887); Wolle, Bull. Torr. Club 6: 184 (1877).—Wolle described the filaments of *S. Brandegeei* as 38–42 μ in diameter, but I find none

[1] The TYPE of *S. evanescens* in the New York Botanical Garden, PUERTO RICO: on limestone, Arecibo to Utuado, *Wille 1482*, should without hesitation be referred to *S. densum* in spite of Geitler's suggestion in Rabenh. Krypt.-Fl. 14: 785 (1932) that *S. evanescens* is an ecological or growth form of *S. Myochrous*. However, other specimens cited with Gardner's description are lichenized masses of *S. Myochrous*.

in the original material exceeding 35 μ in diameter. Specimens seen: NEW YORK: Niagara, Aug. 1876 (F, P; Rabenh. Alg. 2492, N). NEW JERSEY: with *S. figuratum*, Morris Pond (P). PENNSYLVANIA: Bethlehem, 1874, 1875 (F); moist rocks, 1877 (N, U); Rockdale, 1883 (P). COLORADO: wet rocks (TYPE of *S. Brandegeei*, P, isotype, N).

References: as *S. Hegetschweileri* in Wolle, Bull. Torr. Club 6: 139 (1877) in part, ibid. 6: 284 (1879); as *S. cataracta* in Wolle, Rabenh. Alg. 2492 (1877) in part, F. W. Alg. 252 (1887); as *S. Myochrous* in Wolle, loc. cit. (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889), in Setchell, Erythea 4: 192 (1896), in Tilden, Minn. Alg. 1: 224 (1910).

SCYTONEMA FIGURATUM Ag. ex Born. & Flah., ibid. 5: 101 (1887). *S. Austinii* Wood ex Born. & Flah. sp. inquir., ibid. 5: 111 (1887); Wood, Smiths. Contrib. Knowl. 241: 58 (1872). *Symphyosiphon Austinii* Wood apud Wolle, F. W. Alg. 261 (1887). *Scytonema gracile* var. *tolypotrichoides* Wittr. ex Born. & Flah. sp. inquir., loc. cit. (1887); Wolle in Wittr. & Nordst. Alg. exs. 8: 389 (1880), Bull. Torr. Club. 8: 38 (1881). *S. mirabile* Born., Bull. Soc. Bot. France 36: 155 (1889), not Wolle.—See notes under *S. crustaceum* of this paper. The isotype of *S. Austinii* cited here bears the note in Francis Wolle's handwriting: "Same as sent to Dr. Wood" [by C. F. Austin]. Specimens seen: NEW YORK: Niagara, 1876 (P; Rabenh. Alg. 2492, N). NEW JERSEY: Morris Pond, July 1879 (TYPE of *S. gracile* var. *tolypotrichoides*, Wittr. & Nordst. Alg. exs. 389, PW; isotype, N); with *Stigonema ocellatum*, old path, Closter, Nov. 1877 (P). PENNSYLVANIA: Bethlehem (F). NORTH CAROLINA: Warren Springs, French Broad River, *Smith*, Aug. 1880 (U). SOUTH CAROLINA: Aiken, on the ground, *Ravenel 545* (PW), logs under water, *Ravenel 472, 475* (F, PW), damp face of clay cliff, *Ravenel 82* (BM), wet timber at Benton's old mill, *Ravenel 111, 113* (BM). FLORIDA: *Smith*, Mar. 1878 (U).

References: as *S. Hegetschweileri* in Wolle, Bull. Torr. Club 6: 139 (1877) in part; as *S. cataracta* in Wolle, Rabenh. Alg. 2492 (1877) in part; as *S. Notarisii* in Wolle, Bull. Torr. Club 6: 284 (1879); as *S. polymorphum* in Wolle, loc. cit. (1879), F. W. Alg. 255 (1887) in part; as *S. turfosum* in Wolle, Bull. Torr. Club 6: 284 (1879), Amer. Quart. Microsc. Journ. 1: 207 (1879), F. W. Alg. 253 (1887); as *S. simplex* in Wolle, ibid. 259 (1887), in Tilden, Minn. Alg. 1: 229 (1910); as *S. tolypotrichoides* in Wolle, Britton Final Rep. Geol. N. J. 2: 604 (1889), in Setchell, Erythea 4: 192 (1896), in Tilden, ibid. 222 (1910); as *S. mirabile* in Setchell, ibid. 4: 193 (1896), in Tilden, loc. cit. in part (1910); as *S. Austinii* in Tilden, ibid. 220 (1910), in Geitler, Rabenh. Krypt.-Fl. 14: 759 (1932).

SCYTONEMA TOLYPOTRICHOIDES Kütz. ex Born. & Flah., ibid. 5: 100 (1887).—This species passes under the name *S. Archangelii* in recent North American phycological literature. Specimens seen: NEW JERSEY: 'S. calotrichoides' (U); pond (O); Browns Mills, 1879

(D, P). MARYLAND: Falls of Deep Creek, Garrett County, *Smith*, July 1878 (P). FLORIDA: *Smith*, Mar. 1878 (P, U).

References: as *Schizosiphon Meneghinianus* in Wolle, Bull. Torr. Club 6: 284 (1879); as *Calothrix mirabilis* in Wolle, ibid. 6: 285 (1879); as *C. Meneghiniana* in Wolle, F. W. Alg. 238 (1887); as *Scytonema calotrichoides* f. *natans* in Wolle, ibid. 251 (1887); as *S. natans* in Wolle, ibid. 252 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *Plectonema mirabile* in Wolle, F. W. Alg. 266 (1887) in part; as *Scytonema calotrichoides* of Wolle, Britton Final Rep. Geol. N. J. 2: 605 (1889); as *S. tolypotrichoides* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 7 (1939); as *Dichothrix Meneghiniana* in Tilden, ibid. 277 (1910) in part.

SCYTONEMA HOFMANNII Ag. ex Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 97 (1887). *S. cortex* Wood ex Born. & Flah. pro. synon., ibid. 98 (1887); Wood, Proc. Amer. Philos. Soc. 11: 130 (1869). *Sirosiphon scytonematoides* Wood ex Born. & Flah. pro. synon., ibid. 117 (1887); Wood, ibid. 134 (1869). *Scytonema cortex* f. *corrugatum* Wolle, F. W. Alg. 257 (1887). *S. cortex* f. *brunneum* Wolle, ibid. 258 (1887). *S. Hofmannii* f. *brunneum* Wolle apud Forti, Syll. Myxophyc. 515 (1907).—The many specimens in the Farlow Herbarium referred by Wood and Ravenel to *Sirosiphon scytonematoides* consist of the same types of swollen and lichenized filaments as those which occur in the material labeled *Scytonema cortex* f. *corrugatum* by Wolle. Bornet & Flahault (ibid.), however, have placed Wood's *Sirosiphon scytonematoides* in synonymy with their *Hassallia byssoidea*. In the present study, which has involved an examination of a large series of this lichenized form from southern United States, the West Indies, and Central America, it has seemed more reasonable to refer it to *Scytonema Hofmannii*. Specimens seen: NEW YORK: Haverstraw, *Austin*, Oct. 1869 (P); Niagara, Aug. 1876 (P). NEW JERSEY: on stones in damp woods, Closter, *Austin* (P). SOUTH CAROLINA: on bark of *Platanus occidentalis*, *Ravenel 47* (ISOTYPE of *Scytonema cortex*, F); Aiken, *Ravenel 137* (F), *211* (BM), *222*, *241* (F), clay cliffs, *Ravenel 218* (F). GEORGIA: bark, red cedar, *Ravenel*, Apr. 1878 (P); on Juniperus, Darien, *Ravenel 292*, *322*, (F); on oak, Darien, *Ravenel 306* (F). FLORIDA: St. Lucian River, *Smith*, Mar. 1878 (P); on *Myrica cerifera*, *Ravenel 10* (ISOTYPE of *Sirosiphon scytonematoides*, P), *37* (BM); *Smith*, Mar. 1878 (TYPE of *Scytonema cortex* f. *corrugatum*, P; isotype, U).

References: as *S. chrysochlorum* in Wolle, Bull. Torr. Club 6: 139 (1877) in part; as *S. cortex* var. *corrugatum* 'var. nov.' in Wolle, ibid. 6: 284 (1879); as *S. cortex* var. *brunneum* 'var. nov.' in Wolle, loc. cit. (1879); as *S. cortex* in Wolle, F. W. Alg. 256 (1887); as *S. tomentosum* in Wolle, ibid. 262 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *Sirosiphon scytonematoides* in Wolle, F. W. Alg. 271 (1887); as *Scytonema Hofmannii* in Tilden, Minn. Alg. 1: 216 (1910); as *S. Hofmannii* f. *brunneum* in Tilden, ibid. 217 (1910).

SCYTONEMA VARIUM Kütz. ex Born. & Flah., ibid. 5: 97 (1887).—Specimens seen: PENNSYLVANIA: 'S. chrysochlorum' (D, P); Bushkill, 1875 (P). FLORIDA: Fort Meade, *Smith*, May 1880 (U).

References: as *S. chrysochlorum* in Wolle, F. W. Alg. 253 (1887) in part; as *S. varium* in Tilden, Minn. Alg. 1: 217 (1910) in part.

SCYTONEMA OCELLATUM Lyngb. ex Born. & Flah., ibid. 5: 95 (1887).—Specimens seen: NEW JERSEY: dry rocks, Goodwinsville, *Austin*, 1869 (P). PENNSYLVANIA: clay banks, Oct. 1875 (P). GEORGIA: on old bricks etc., Darien, *Ravenel 449*, Nov. 1881 (F); on oak, Darien, Mar. 1881 (BM).

References: as *S. Naegelii* in Wolle, Bull. Torr. Club 6: 184 (1877), F. W. Alg. 252 (1887), Britton Final Rep. Geol. N. J. 2: 604 (1889); as *S. cinereum* in Wolle, Bull. Torr. Club 6: 184 (1877), F. W. Alg. 258 (1887), Britton Final Rep. Geol. N. J. 2: 605 (1889); as *S. ocellatum* in Tilden, Minn. Alg. 1: 218 (1910); as *Tolypothrix penicillata* in Tilden, ibid. 232 (1910) in part.

SCYTONEMA GUYANENSE (Mont.) Born. & Flah., Ann. Sci. Nat. VII Bot. 5: 94 (1887). *Symphyosiphon Wollei* Born. ex Born. & Flah. pro. synon., loc. cit. (1887); Bornet in Wolle, Bull. Torr. Club 6: 139 (1877). *Scytonema guyanense* var. *minus* Gardn., Mem. New York Bot. Gard. 7: 79 (1927).—See notes under *Calothrix pulvinata* of this paper. Specimens seen: PENNSYLVANIA: Oct. 1876 (F); on limestone rocks, Depot Hill, Oct. 1874 (ISOTYPES of *Symphyosiphon Wollei*, F, N, P). SOUTH CAROLINA: on *Acer rubrum*, Aiken, *Ravenel 176* (F); base of Nyssa, Aiken, *Ravenel 70* (F).

Reference: as *S. guyanense* in Tilden, Minn. Alg. 1: 220 (1910).

SCYTONEMA STUPOSUM (Kütz.) Born. ex Born. & Flah., ibid. 5: 92 (1887). *S. caldarium* Setch.,[1] Erythea 7: 48 (1899). *S. azureum* Tild.,[1] Amer. Alg. 7: 630 (1909).—Specimens seen: FLORIDA: *Smith*, Mar. 1878 (U). JAMAICA: 'Jamaica' (P).

References: as *S. intertextum* in Wolle, Bull. Torr. Club 6: 284 (1879), F. W. Alg. 258 (1887), in Tilden, Minn. Alg. 1: 219 (1910).

SCYTONEMA CINCINNATUM (Kütz.) Thur. ex Born. & Flah., ibid. 5: 89 (1887). *S. crispum* (Ag.) Born., Bull. Soc. Bot. France 36: 157 (1889).—Specimens seen: PENNSYLVANIA: Quakertown (P); 'Lyngbya cincinnata' (U); stagnant water (O); 1880 (N). FLORIDA: *Smith*, Mar. 1878 (U).

References: as *S. cincinnatum* in Wolle, Bull. Torr. Club 8: 38 (1881), F. W. Alg. 254 (1887); as *Tolypothrix distorta* in Wolle, ibid. 263 (1887) at least in part, Tilden, Minn. Alg. 1: 231 (1910) in part; as *Lyngbya cincinnata* in Wolle, ibid. 296 (1887) in part; as *Scytonema crispum* in Tilden, ibid. 214 (1910).

[1] I cannot distinguish the isotypes of these two species from other specimens of *S. stuposum:* CALIFORNIA: Waterman Hot Springs, San Bernardino, *S. B. Parish*,

Oscillatoriaceae

PORPHYROSIPHON NOTARISII (Menegh.) Kütz. ex Gom., Ann. Sci. Nat. VII Bot. 15: 331 (1892); Drouet, Amer. Journ. Bot. 24: 601 (1937). *Scytonema Kaernbachii* Henn., Bot. Jahrb. 15 (Beibl. 33): 8 (1892). *Microcoleus Ravenelii* Wolle ex Gom. sp. inquir., ibid. 15: 361 (1892); Wolle, F. W. Alg. 307 (1887). *Porphyrosiphon Kaernbachii* De Toni, Nuova Notar. 3: 134 (1892). *Lyngbya Notarisii* Wille ex Forti pro. synon., Syll. Myxophyc. 314 (1907). *Hydrocoleum Ravenelii* Wolle ex Forti, ibid. 322 (1907); Wolle, Bull. Torr. Club 6: 183 (1877). *Lyngbya arboricola* Brühl & Bisw., Journ. Dept. Sci. Univ. Calcutta 5 (Bot. 1): 7 (1923). *L. dendrobia* Brühl & Bisw., ibid. 8 (1923). *L. splendens* Gardn., Mem. New York Bot. Gard. 7: 40 (1927). *Porphyrosiphon Notarisii* var. *major* Gardn., ibid. 41 (1927). *P. robustus* Gardn., loc. cit. (1927). *Phormidium durum* Gardn.,[1] ibid. 45 (1927).—Wolle's specimen bearing the label 'Hydrocoleum heterotrichum' (apparently the basis for the sole report of this species from North America) consists of a mass of rather poorly preserved algae of which the principal species are *Hapalosiphon pumilus, Schizothrix Muelleri,* and *Porphyrosiphon Notarisii.* The published description and figure and the annotation "with H. versicolor" on the label prove beyond doubt that Wolle referred to the last species as *Hydrocoleum heterotrichum.* In my recent treatment of the Brazilian flora in Amer. Journ. Bot., vols. 24 and 25, I discussed the synonymy of *Porphyrosiphon Notarisii* displayed above and listed, among others, American specimens from North Carolina, South Carolina, Florida, Missouri, Texas, Puerto Rico, Cuba, Jamaica, Ceará, Maranhão, Pará, Venezuela, and Ecuador. Additional American material, along with that seen by Francis Wolle, is given here: NEW JERSEY: dryish ground along an unfrequented part of an old field, Closter, *Austin,* 1864 (P), 1866 (F). PENNSYLVANIA: from swamp near Bethlehem (P); marsh pool below Nisky (PW). VIRGINIA: Prince Edward County, *Smith,* Apr. 1878 (U). NORTH CAROLINA: Winston-Salem, *L. D. de Schweinitz* (Pa). SOUTH CAROLINA: on damp earth, Aiken, *Ravenel 33* (N), *59* (F), *188* (BM). FLORIDA: *Smith,* Mar. 1878 (P, PW, U); on ground in sandy places, Gainesville, *Ravenel 5, 7, 20, 29* (F, N, P). LOUISIANA:

Apr. 1897 (ISOTYPES of *S. caldarium* Setch., Phyc. Bor.-Amer. 559, FM, T). TERRITORY OF HAWAII: "warm spring," Puna, Hawaii, *J. E. Tilden,* July 1900 (ISOTYPE of *S. azureum,* Tild., Amer. Alg. 630, FM).

[1] The TYPE of *Phormidium durum* in the New York Botanical Garden, PUERTO RICO: on shaded rocks near Hacienda Catalina near Palmer, *Wille 746,* Jan. 1915, is typical material of *Porphyrosiphon Notarisii.*

on ground in swampy wood, *A. B. Langlois*, Sept. 1891 (U); on damp soil, Albany, *G. W. Prescott*, June 1938 (D). NEBRASKA: on wet and dripping sandstone, Weeping Water, *T. A. Williams*, Mar. 1888 (U). KANSAS: on soil in scrub oak woodland, Chautauqua, *W. E. Booth 1*, July 1939 (FM). OKLAHOMA: in an abandoned field, Stroud, Lincoln County, *Booth 5*, July 1939 (FM). TEXAS: on ground in pasture, Houston, *Ravenel* (TYPE of *Microcoleus Ravenelii*, P; isotypes, F, N). BAHAMA ISLANDS: Maidenhead Coppice, New Providence, *E. G. Britton 3244*, Feb. 1905 (N), *L. J. K. Brace 9916*, Jan. 1919 (N). JAMAICA: with *Scytonema Hofmannii*, Castleton, *J. E. Humphrey*, Apr. 1893 (G); Arntully, *C. R. Orcutt 2708, 7021*, 1927–28 (D, F, N, U); trail to Cinchona, *Orcutt 5501*, 1928 (D, F, N, U); headwaters of Buff River, *Orcutt 3793* (D, F, N, U). SURINAM: *Christoph Weigelt* in herb. Schweinitz[1] (Pa).

References: as *Hypheothrix pallida* in Wolle, Bull. Torr. Club 6: 182 (1877), in Tilden, Minn. Alg. 1: 144 (1910); as *Hydrocoleum phormidioides* in Wolle, ibid. 6: 183 (1877) in part; as *H. heterotrichum* in Wolle, ibid. 6: 283 (1879) in part, in Tilden, ibid. 138 (1910) in part, in Smith, Freshw. Alg. U. S. 84 (1933) in part; as *Phormidium Naveanum* in Wolle, loc. cit. (1879), in Tilden, ibid. 102 (1910); as *Scytonema polymorphum* in Wolle, ibid. 6: 284 (1879), F. W. Alg. 255 (1887) in part; as *S. Notarisii* in Wolle, Bull. Torr. Club 6: 284 (1879) in part; as *Lyngbya Naveana* in Wolle, F. W. Alg. 298 (1887); as *L. pallida* in Wolle, loc. cit. (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889); as *Microcoleus heterotrichus* f. *americanus* in Wolle, F. W. Alg. 307 (1887) in part; as *Oscillaria Froelichii* var. *neglecta* in Wolle, ibid. 316 (1887) in part; as *Hydrocoleum Ravenelii* in Tilden, ibid. 138 (1910), in Geitler, Rabenh. Krypt.-Fl. 14: 1154 (1932); as *Porphyrosiphon Notarisii* in Smith, ibid. 82 (1933) in part.

SCHIZOTHRIX PURPURASCENS var. CRUENTA (Lespin.) Gom., Ann. Sci. Nat. VII Bot. 15: 321 (1892). *Hydrocoleum rufescens* Gardn., Mem. New York Bot. Gard. 7: 57 (1927).—This is one of the several species comprising the material distributed by Wolle as *Phormidium congestum*: see under *Cylindrospermum majus* of this paper. Specimens seen: NEW YORK: sandy deposit, Aug. 1876 (F). NEW JERSEY: with *Stigonema ocellatum* on old path, Closter, Nov. 1877 (P). PENNSYLVANIA: with *Schizothrix Muelleri* on old wood, Rockdale, Aug. 1877 (P). SOUTH CAROLINA: ground in woods, Aiken, *Ravenel 186* (BM), *500*, Nov. 1883 (PW). FLORIDA: *Smith*, Mar. 1878 (P, U).

References: as *Lyngbya Phormidium* in Wolle, F. W. Alg. 299 (1887) in part; as *Microcoleus terrestris* in Wolle, ibid. 305 (1887) in part; as *M. vaginatus* in Tilden, Minn. Alg. 1: 157 (1910) in part.

[1] Dr. Barnhart's surmise (Mem. Torr. Bot. Club 16: 250, footnote. 1921) that the Surinam plants of the Schweinitz herbarium were of the collection of Christoph Weigelt and were communicated to Dr. L. D. de Schweinitz by Dr. Constantine Hering appears to be correct. In the manuscript catalogue of the

SCHIZOTHRIX LAMYI Gom., ibid. 15: 323 (1892).—Specimens seen: SOUTH CAROLINA: Aiken, *Ravenel 216, 284,* Feb. 1878 (F, P), *154* (BM).

References: as *Microcoleus terrestris* in Wolle, F. W. Alg. 305 (1887) in part; as *M. vaginatus* in Tilden, Minn. Alg. 1: 157 (1910) in part.

SCHIZOTHRIX **Wollei, nom. nov.** *Microcoleus pulvinatus* Wolle ex Gom. sp. inquir., Ann. Sci. Nat. VII Bot. 15: 361 (1892); Wolle, F. W. Alg. 305 (1887). Stratum molle, expansum, aerugineum aut fuscum, lapides et plantas aquaticas investiens, usque ad 5 cm.

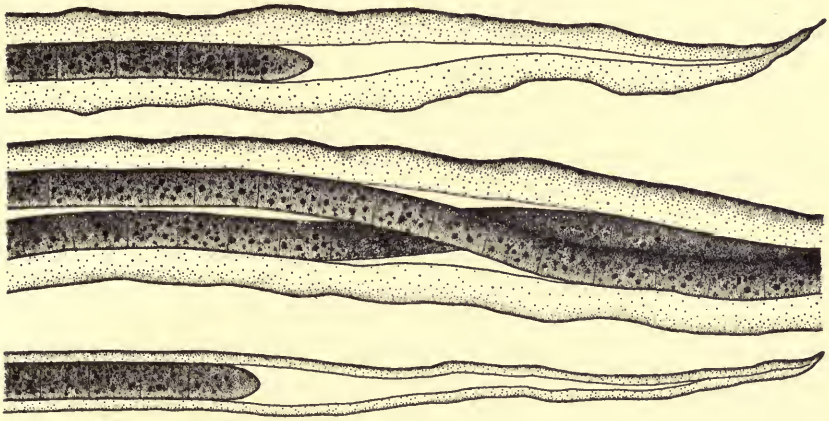

FIGURE 1. *Schizothrix Wollei* Drouet: upper ends of filaments.

altum, filis elongatis, substrictis aut subflexuosis, penicillatim aggregatis, fasciculatim pseudo-ramosis pseudo-ramis subadpressis, inferne subsimplicibus; vaginis hyalinis demum luteolis, non aut modice lamellosis, chlorozincico iodurato pulchre caerulescentibus, ambitu irregularibus aut erosis, frequenter (in speciminibus siccis) transverse plicatis, crassis vel in statu juvenili tenuibus cylindraceisque; trichomatibus aerugineis, ad genicula non aut leviter constrictis, 4 μ ad 6 μ crassis, plerumque intra vaginam singulis binisve aut ad bases filorum usque ad quinqueis, apice non aut leviter attenuata; articulis diametro trichomatis longioribus, raro subquadratis, 3.5 μ ad 10 μ longis; protoplasmate dense grosse-granuloso, dissepimentis haud granulatis; cellula apicali rotundata vel obtuse conica (v. s.). **Fig. 1.** —This species is easily recognizable among others of the section *Chromosiphon* Gom. by its aquatic habit, the resemblance of its

Schweinitz collection at the Academy of Natural Sciences, Philadelphia, occurs a list of Schweinitz's correspondents. Here we find the entry: "Hering, Dr. Surinam —innumerae Weigelt collect."

filaments to those of *Schizothrix Friesii*, and its sheaths which become thick and yellow-brown in age. Visits to the type locality, the mill-race at Bamber Lake, Ocean County, New Jersey, by Dr. Ruth Patrick, Dr. Charles Hodge, and myself in early winter have failed to discover the species in the living condition. It has fortunately appeared in recent collections by Miss Joan Bader at a station not far distant. Specimens seen: NEW JERSEY: "attached to stones and larger aquatic plants in rapidly running water," Bamber, Sept. 1882 (TYPE in Herb. Univ. Pennsylvania; isotype, D); gelatinous layer in swamp, shallow water, Toms River, *J. E. Bader 221*, Oct. 1938 (FM). PENNSYLVANIA?: 'Hydrocoleum tinctorium' (P); 'in Pennsylvania' (Wittr. & Nordst. Alg. exs. 869b, N, PW).

References: as *Hydrocoleum tinctorium* in Wolle, Bull. Torr. Club 6: 183 (1877); as *Stigonema ocellatum & Hapalosiphon pumilus* in Wolle, Wittr. & Nordst. Alg. exs. 18: 869b (1889); as *Microcoleus pulvinatus* in Wolle, Britton Final Rep. Geol. N. J. 2: 609 (1889), in Forti, Syll. Myxophyc. 379 (1907), in Tilden, Minn. Alg. 1: 158 (1910); as *Inactis tinctoria* in Tilden, ibid. 149 (1910) in part.

SCHIZOTHRIX MUELLERI Näg. ex Gom., ibid. 15: 321 (1892). *Hydrocoleum Hieronymii* Richt., Hauck & Richt. Phyk. univ. 543 (1892).—Some of the specimens marked 'Dasygloea amorpha' are excellently preserved material of *Schizothrix Muelleri*; others contain masses of shrunken hormogonia which, though scarcely recognizable at first sight, cannot but be referred to this species also. The specimen from New York cited here is part of the material labeled *Phormidium congestum* by Wolle: see under *Cylindrospermum majus* of this paper. Specimens seen: NEW YORK: sandy deposit, August 1876, with *Microcoleus lacustris* and *Schizothrix purpurascens* (C, F). NEW JERSEY: *Austin* (P). PENNSYLVANIA: old wood, Rockdale, Aug. 1877 (P); Glen Onoko, Mt. Glen (D, F, N, O, P, U). MARYLAND: with *Schizothrix Friesii*, Falls of Deep Creek, Garrett County, *Smith*, July 1878 (U).

References: as *Hydrocoleum versicolor* in Wolle, Bull. Torr. Club 6: 138 (1877); as *Dasygloea amorpha* in Wolle, ibid. 6: 183 (1877), in Tilden, Minn. Alg. 1: 154 (1910), in Smith, Freshw. Alg. U. S. 85 (1933); as *Hydrocoleum phormidioides* in Wolle, loc. cit. (1877) in part; as *Phormidium fasciculatum* in Wolle, ibid. 6: 283 (1879); as *Lyngbya Phormidium* in Wolle, F. W. Alg. 299 (1877) in part; as *Microcoleus amorpha* in Wolle, ibid. 304 (1887); as *Schizothrix Muelleri* in Tilden, ibid. 152 (1910), in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 7 (1939).

SCHIZOTHRIX CHALYBEA (Kütz.) Gom., ibid. 15: 319 (1892).—For notes on the distribution of this species see Drouet, Bull. Torr. Club 64: 603 (1937). One specimen: FLORIDA: with *Scytonema crustaceum*, *Smith*, Mar. 1878 (P).

SCHIZOTHRIX FRIESII (Ag.) Gom., Ann. Sci. Nat. VII Bot. 15: 316 (1892). *Symplocastrum Friesii* Kirchn. ex Forti, Syll. Myxophyc. 347 (1907); Kirchn. (the name ineffectively published), Schizophyc. 68 (1900). *Schizothrix Purcellii* Proc. Acad. Nat. Sci. Phila. 80: 91 (1928). *Symplocastrum Brittoniae* Gardn., New York Acad. Sci. Sci. Surv. Puerto Rico 8: 287 (1932).—Specimens seen: CANADA: *Macoun* (P). NEW YORK: Suffern, *E. B.* (P). NEW JERSEY: *Austin* (P); on the ground, Hoboken, *N. L. B. & E. G. L.*, Oct. 1884 (N, PW); Closter, *Austin 399, 401, 455*, (F, P); with *Stigonema ocellatum*, old path, Closter, Nov. 1877 (P). PENNSYLVANIA: clay banks (P, U); Lehigh Mt., Aug. 1884 (PW); 1875 (P); Sept. 1876 (F); shaded banks (N). MARYLAND: Falls of Deep Creek, Garrett County, *Smith*, July 1878 (P, U); Spesutie Island, Harford County, *Smith*, Oct. 1878 (P, U). SOUTH CAROLINA: damp clay, Aiken, *Ravenel 219, 244, 245, 448* (F), Sept. 1869 (BM). FLORIDA: *Smith*, Mar. 1878 (P).

References: as *Symploca lucifuga* in Wolle, Bull. Torr. Club 6: 138 (1877) F. W. Alg. 303 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889) in part; as *Phormidium lyngbyaceum* in Wolle, Bull. Torr. Club 6: 183 (1877) in part; as *Symploca Friesiana* in Wolle, loc. cit. (1877), F. W. Alg. 304 (1887); as *Phormidium rupestre* in Wolle, Bull. Torr. Club 6: 283 (1879); as *Symploca fuscescens* in Wolle, loc. cit. (1879), F. W. Alg. 304 (1887), in Tilden, Minn. Alg. 1: 131 (1910); as *Lyngbya Phormidium* in Wolle, ibid. 299 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889) in part; as *L. Retzii* in Wolle, F. W. Alg. 302 (1887) in part; as *Phormidium Retzii* in Tilden, ibid. 102 (1910) in part; as *Schizothrix Friesii* in Tilden, ibid. 146 (1910).

SCHIZOTHRIX ARENARIA (Berk.) Gom., ibid. 15: 312 (1892). *Hypheothrix aikenensis* Wolle ex Forti, Syll. Myxophyc. 329 (1907); Wolle, Bull. Torr. Club 6: 182 (1877). *H. arenaria* Forti, ibid. 342 (1907). *Schizothrix aikenensis* Philson, Journ. Elisha Mitchell Sci. Soc. 55: 96 (1939).—Specimens seen: NEW JERSEY: Closter, 1864 (P), 1871 (F, P). SOUTH CAROLINA: sluggish pools, Aiken, *Ravenel 243* (TYPE of *H. aikenensis*, P), *465* (PW); wet ground, Aiken, *Ravenel 242, 254, 286* (F); on wet wood, Aiken, *Ravenel 472*, Nov. 1881 (F). FLORIDA: *Smith*, Mar. 1878 (P).

References: as *Microcoleus terrestris* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 305 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889), in part; as *Hypheothrix coriacea* f. *Meneghinii* in Wolle, Bull. Torr. Club 6: 182 (1877), in Tilden, Minn. Alg. 1: 142 (1910); as *Scytonema thermale* in Wolle, F. W. Alg. 259 (1887) in part; as *Hypheothrix aikenensis* in Tilden, ibid. 141 (1910); as *Microcoleus vaginatus* in Tilden, ibid. 157 (1910) in part.

SCHIZOTHRIX LARDACEA (Ces.) Gom., ibid. 15: 307 (1892). *Hypheothrix lardacea* Hansg., Dalla Torre & Sarnth. Fl. Tirol Verarlb. & Liechtenst. 2: 144 (1901).—Specimens seen: PENNSYLVANIA: Rock-

dale, Aug. 1877 (P). TERRITORY OF HAWAII: 'Sandwich Islands' (PW).

References: as *H. turicensis* in Wolle, Bull. Torr. Club 6: 182 (1877), in Tilden, Minn. Alg. 1: 141 (1910).

SCHIZOTHRIX CALCICOLA (Ag.) Gom., ibid. 15: 307 (1892). *Hypheothrix calcicola* Rabenh. ex Gom. pro. synon., loc. cit. (1892).—Specimens seen: PENNSYLVANIA: greenhouse, July 1877 (D, P); June 1876 (P); 'Oscillaria chlorina' (P). VIRGINIA: Petersburg, *Smith*, Apr. 1878 (U). SOUTH CAROLINA: artesian wells, *Smith*, Mar. 1878 (P, U). GEORGIA: on brick walls, Savannah, *Ravenel* (P).

References: as *Oscillaria tenerrima* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 309 (1887), in part; as *Leptothrix muralis* in Wolle, Bull. Torr. Club 6: 182 (1877); as *Mastigothrix aeruginea* in Wolle, ibid. 6: 184 (1877); as *Hypheothrix aeruginosa* in Wolle, ibid. 6: 282 (1879); as *Oscillaria chlorina* in Wolle, F. W. Alg. 311 (1887) in part; as *Leptothrix calcicola* in Wolle, ibid. 319 (1887); as *L. aeruginea* in Wolle, loc. cit. (1887); as *L. herbacea* in Wolle, ibid. 320 (1887); as *L. caespitosa* in Wolle, loc. cit. (1887) in part; as *Hypheothrix herbacea* in Tilden, Minn. Alg. 1: 140 (1910).

SCHIZOTHRIX LACUSTRIS A. Br. ex Gom., Ann. Sci. Nat. VII Bot. 15: 301 (1892). *Inactis lacustris* Forti, Syll. Myxophyc. 354 (1907).—Specimens seen: NEW YORK: Niagara, Aug. 1876 (D, P); Portage, Aug. 1876 (P). PENNSYLVANIA: stones, Lehigh River, Sept. 1876 (P). SOUTH CAROLINA: Northampton Swamp, *Ravenel 14* (BM).

References: as *Leptothrix caespitosa* in Wolle, Bull. Torr. Club 6: 182 (1877), F. W. Alg. 320 (1887), in part; as *Mastigonema caespitosum* of Wolle, Bull. Torr. Club 6: 138 (1877) in part; as *M. planum* in Wolle, loc. cit. (1877) in part; as *Isactis fluviatilis* in Wolle, F. W. Alg. 244 (1887); as *I. caespitosa* in Wolle, loc. cit. (1887) in part; as *I. plana* in Tilden, Minn. Alg. 1: 281 (1910) in part.

SCHIZOTHRIX VAGINATA (Näg.) Gom., ibid. 15: 302 (1892). *Inactis vaginata* Näg. ex Gom. pro. synon., loc. cit. (1892).—One collection: SOUTH CAROLINA: hillsides, Aiken, *Ravenel 546*, Dec. 1884 (PW).

HYDROCOLEUM GLUTINOSUM (Ag.) Gom., Ann. Sci. Nat. VII Bot. 15: 339 (1892).—Specimens seen: MASSACHUSETTS: Woods Hole, *W. G. Farlow*, Aug. 1875 (P). NEW JERSEY: Passaic River, Belleville, *Hitchcock*, July 1881 (U).

References: as *Lyngbya majuscula* in Wolle, F. W. Alg. 297 (1887), Britton Final Rep. Geol. N. J. 2: 607 (1889).

MICROCOLEUS CHTHONOPLASTES (Fl. Dan.) Thur. ex Gom., ibid. 15: 353 (1892).—One specimen, apparently not mentioned by Wolle: NEW JERSEY: submarine soil, with *Lyngbya aestuarii* (U).

MICROCOLEUS ACUTISSIMUS Gardn., Mem. New York Bot. Gard. 7: 55 (1927); Drouet, Amer. Journ. Bot. 24: 603 (1937). *M. pur-*

pureus Gardn., ibid. 56 (1927). *Oscillatoria claricentrosa* Gardn.,[1] ibid. 37 (1927).—One specimen: FLORIDA: with *Scytonema crustaceum, Smith,* Mar. 1878 (P).

MICROCOLEUS LACUSTRIS Farl. ex Gom., ibid. 15: 359 (1892).—This and several other species of filamentous Myxophyceae are contained in the material labeled by Wolle 'Phormidium congestum': see under *Cylindrospermum majus* of this paper. Specimens seen: MASSACHUSETTS: Boston, *W. G. Farlow,* Dec. 1876 (P). NEW YORK: sandy deposit, Aug. 1876 (C). SOUTH CAROLINA: on the ground, Aiken, *Ravenel 237* (P).

References: as *Phormidium congestum* in Wolle, Bull. Torr. Club 6: 138 (1877) in part; as *Microcoleus terrestris* in Wolle, F. W. Alg. 305 (1887) in part; as *M. lacustris* in Setchell, Erythea 7: 52 (1899), in Tilden, Minn. Alg. 1: 157 (1910); as *M. vaginatus* in Tilden, ibid. 156 (1910).

PLECTONEMA WOLLEI Farl. ex Gom., Ann. Sci. Nat. VII Bot. 16: 98 (1892); Farlow, Bull. Bussey Inst. 2: 77 (1877). *Lyngbya Wollei* Farl. ex Gom. pro. synon., loc. cit. (1892).—Certain authors have remarked that *Plectonema Wollei* and *Lyngbya majuscula* are difficult to distinguish from each other. In herbarium specimens and other material upon which records in recent local floras have been based, the confusion of the two species is very evident. The 'characters' of the greatest diagnostic value here are, of course, the presence of false branching of the filaments of the former species and the absence of it in the latter. My experience with *Plectonema Wollei* and other Myxophyceae with branching filaments has shown that the greatest number of branchings are to be found in the oldest parts of the plant mass, often not at all at the surface of the mass. The reason for this is obvious: the youngest parts of the filaments at the surface exist in an unbranched condition before branches are formed. *P. Wollei* and *Lyngbya majuscula,* though similar in size of trichome and filament, have many dissimilarities, in texture and thickness of the sheath, in granulation and color of the protoplasm, in nature of the walls, in shapes of cells, and in the macroscopic appearance of the masses. Such differences become instantly apparent when one compares material growing in strictly marine waters (*L. majuscula*) with that from purely fresh water (*Plectonema Wollei*). Specimens seen: MASSACHUSETTS: lapidibus adnatum (Wittr. & Nordst. Alg. exs. 279, N, PW); Woburn, *W. G. Farlow,* 1876 (F, P). NEW JERSEY: Swartwood Lake, Sussex County, 1879 (P); *Hitchcock* (U). PENN-

[1] The TYPE of *Oscillatoria claricentrosa* in the New York Botanical Garden, PUERTO RICO: in a ditch by road to the Playa, Fajardo, *Wille 697,* Jan. 1915, is similar to the type of *Microcoleus acutissimus.*

SYLVANIA: Lehigh River, Sept. 1874 (P), Aug. 1876 (P), Oct. 1878 (P); Bethlehem (B, F; Rabenh. Alg. 2440, N, T); rivers & ponds (O). FLORIDA: in running stream from spring near Gainesville, *Ravenel 30*, Dec. 1877 (F, P). OHIO: Rat Island, *B. Romig*, 1878 (P).

References: as *Lyngbya Wollei* in Wolle, Rabenh. Alg. 2440 (1876), F. W. Alg. 297 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889); as *Plectonema Wollei* in Wolle, Bull. Torr. Club 6: 139 (1877), Wittr. & Nordst. Alg. exs. 6: 279 (1879), in Tilden, Minn. Alg. 1: 208 (1910).

PLECTONEMA TOMASINIANUM (Kütz.) Born. ex Gom., ibid. 16: 99 (1892). *Lyngbya subconfervoides* Borge, Ark. f. Bot. 15 (13): 91 (1919).—Specimens seen: NEW JERSEY: pond, July 1879 (P). PENNSYLVANIA: Krause Spring, Oct. 1878 (P), Oct. 1875 (F); calcareous springs (O, P); limestone spring, Feb. 1877 (F. O); Heyrich Spring, July 1876 (P), 1880 (N); in aqua stagnante prope Bethlehem, Apr. 1879 (Wittr. & Nordst. Alg. exs. 391, N, PW); Bethlehem, in Quellen auf Holz und Wassergewächsen (Rabenh. Alg. 2493, N); Derry Church, Dauphin County, Oct. 1887 (PW); stagnant waters (D, N, P).

References: as *Plectonema mirabile* in Wolle, Rabenh. Alg. 2493 (1877), Bull. Torr. Club 6: 139 (1877), Wittr. & Nordst. Alg. exs. 8: 391 (1880), F. W. Alg. 266 (1887) in part; as *Tolypothrix muscicola* in Wolle, Bull. Torr. Club 6: 139 (1877), F. W. Alg. 264 (1887) in part; as *Oscillaria Froelichii* var. *phormidioides* in Wolle, Bull. Torr. Club 7: 43 (1880); as *O. Froelichii* in Wolle, F. W. Alg. 315 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889) in part; as *Plectonema Tomasinianum* in Tilden, Minn. Alg. 1: 207 (1910).

PLECTONEMA NOSTOCORUM Born. ex Gom., ibid. 16: 102 (1892).—Specimens seen: PENNSYLVANIA: greenhouse bank (P); June 1876 (F, P). MINNESOTA: on stones, Lake Harriet, *E. Butler*, Nov. 1883 (PW). MONTANA: F. W. *Anderson*, 1886 (PW).

References: as *Oscillaria tenerrima* in Wolle, F. W. Alg. 309 (1887) in part; as *O. gracillima* in Wolle, ibid. 311 (1887) in part; as *Leptothrix rigidula* in Wolle, ibid. 321 (1887) in part; as *Oscillatoria amphibia* in Tilden, Minn. Alg. 1: 73 (1910) in part.

SYMPLOCA MURALIS Kütz. ex Gom., Ann. Sci. Nat. VII Bot. 16: 112 (1892). *S. muralis* var. *minor* Gardn.,[1] Univ. Calif. Publ. Bot. 14: 6 (1927).—Specimens seen: MASSACHUSETTS: Woods Hole, *W. G. Farlow* (P). SOUTH CAROLINA: Aiken, *Ravenel*, 1877 (P, T), *469*, Oct.

[1] This 'variety' does not, in my estimation, deserve a name. In the ten specimens cited by Gardner in the Farlow Herbarium with his original description, it is true that many of the trichomes measure as little as 3 μ in diameter; nevertheless, many very closely approach 4 μ. Otherwise the masses are quite similar to those of specimens of *S. muralis* cited by Gomont. The TYPE, in the Farlow Herbarium, is: CHINA: Kushan, near Foochow, Fukien Province, *H. H. Chung A391*.

1883 (F, PW), *488*, Nov. 1883 (PW), *56*, *92* (F), on the ground, *378*, Dec. 1880 (F); Charleston, Ravenel 335 (F). GEORGIA: brick walls, Savannah, *Ravenel 4* (F).

References: as *Phormidium inundatum* in Wolle, Bull. Torr. Club 9: 25 (1882); as *Lyngbya Retzii* in Wolle, F. W. Alg. 302 (1887) in part; as *L. inundata* in Wolle, ibid. 303 (1887); as *Oscillaria antliaria* in Wolle, ibid. 310 (1887) in part; as *Phormidium Retzii* in Tilden, Minn. Alg. 1: 102 (1910) in part.

SYMPLOCA MUSCORUM (Ag.) Gom., ibid. 16: 110 (1892). *Phormidium Corium* var. *capitatum* Gardn., Univ. Calif. Publ. Bot. 14: 4 (1927). *P. interruptum* var. *capitatum* Gardn., Mem. New York Bot. Gard. 7: 44 (1927).—Specimens seen: MARYLAND: Spesutie Island, Harford County, *Smith*, Oct. 1878 (P); Falls of Deep Creek, Garrett County, *Smith*, July 1878 (U). SOUTH CAROLINA: Langley Mills, Aiken, *Ravenel 486*, Nov. 1883 (PW). FLORIDA: *Smith*, 1877 (P, U).

References: as *Lyngbya vulgaris* in Wolle, F. W. Alg. 300 (1887) in part; as *L. interrupta* in Wolle, ibid. 302 (1887) in part; as *Symploca Muscorum* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 9 (1939).

LYNGBYA AESTUARII (Mert.) Liebm. ex Gom., Ann. Sci. Nat. VII Bot. 16: 127 (1892). *L. aestuarii* f. *aeruginosa* Gom., ibid. 16: 130 (1892).—Specimens seen: MASSACHUSETTS: Woods Hole, *W. G. Farlow*, 1876 (PW). NEW JERSEY: pools and wet ground, Perth Amboy, July 1878 (N, P); submarine soil (U); Dennisville, Cape May County (D, P); ad terram in fossis submarinis, Aug. 1878 (Wittr. & Nordst., Alg. exs. 282, N, PW); salt marshes (O).

References: as *L. aeruginosa* in Wolle, Bull. Torr. Club 6: 283 (1879); as *L. aestuarii* f. *aeruginosa* in Wolle, Wittr. & Nordst. Alg. exs. 6: 282 (1879); as *L. aestuarii* in Wolle, Bull. Torr. Club 8: 38 (1881), F. W. Alg. 296 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889), in Tilden, Minn. Alg. 1: 120 (1910); as *L. obscura* in Wolle, F. W. Alg. 298 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889), in part.

LYNGBYA MAJUSCULA (Dillw.) Harv. ex Gom., ibid. 16: 131 (1892). —One specimen: MASSACHUSETTS: Woods Hole, *W. G. Farlow*, 1874 (PW).

LYNGBYA SEMIPLENA (Ag.) J. Ag. ex Gom., ibid. 16: 138 (1892). *Calothrix Donnellii* (Wolle) Forti, Syll. Myxophyc. 629 (1907). *Mastigonema Donnellii* Wolle ex Forti pro. synon., loc. cit. (1907); Wolle, Bull. Torr. Club 6: 283 (1879).—One collection, FLORIDA: *Smith*, Mar. 1878 (TYPE of *Calothrix Donnellii*, P; isotype, D).

Reference: as *Calothrix Donnellii* in Tilden, Minn. Alg. 1: 271 (1910).

LYNGBYA PUTEALIS Mont. ex Gom., ibid. 16: 143 (1892).—Material seen: GEORGIA: ditches, Darien, *Ravenel 446*, Nov. 1881 (F).

FLORIDA: *Smith*, 1878 (P). ARIZONA: Tucson, *C. G. Pringle*, Apr. 1881 (F).

References: as *Phormidium subtorulosum* in Wolle, Bull. Torr. Club 6: 283 (1879); as *P. tinctorium* in Wolle, ibid. 9: 25 (1882), in Tilden, Minn. Alg. 1: 94 (1910); as *Lyngbya Phormidium* in Wolle, F. W. Alg. 299 (1887) in part; as *L. subtorulosa* in Wolle, ibid. 300 (1887); as *L. tinctoria* in Wolle, ibid. 301 (1887); as *Microcoleus subtorulosus* in Tilden, ibid. 158 (1910).

LYNGBYA VERSICOLOR (Wartm.) Gom., ibid. 16: 147 (1892). *Hypheothrix tenax* Wolle ex Forti, Syll. Myxophyc. 329 (1907); Wolle, Bull. Torr. Club 6: 282 (1879). *Leptothrix tenax* Wolle, F. W. Alg. 319 (1887).—Specimens seen: PENNSYLVANIA: State Quarries, Aug. 1878 (TYPE of *Hypheothrix tenax*, P; isotypes, D, U); pools (O); 'Hypheothrix tenax' (Mi); 'Oscillaria chlorina' (P); Bushkill above Nazareth (N); Bethlehem (B). OHIO: Painesville, *Beardslee*, 1878 (O, P).

References: as *Oscillaria chlorina* in Wolle, F. W. Alg. 311 (1887) in part, in Tilden, Minn. Alg. 1: 75 (1910) in part; as *Lyngbya obscura* in Wolle, ibid. 298 (1887) in part; as *Hypheothrix tenax* in Tilden, ibid. 141 (1910).

LYNGBYA OCHRACEA (Kütz.) Thur. ex Gom., ibid. 16: 149 (1892). —Specimens seen: MASSACHUSETTS: waterworks, Boston, *W. G. Farlow*, July 1877 (P). NEW JERSEY or PENNSYLVANIA: small pools (D, P); Apr. 1877 (F); Pennsylvania? (Wittr. & Nordst. Alg. exs. 1169, N).

References: as *Leptothrix ochracea* in Wolle, Bull. Torr. Club 6: 182 (1877), F. W. Alg. 322 (1887), Britton Final Rep. Geol. N. J. 2: 610 (1889); as *Lyngbya ochracea* in Wolle, Wittr. & Nordst. Alg. exs. 24: 1169 (1893), in Tilden, Minn. Alg. 1: 113 (1910).

PHORMIDIUM LURIDUM (Kütz.) Gom., Ann. Sci. Nat. VII Bot. 16: 165 (1892).—Specimens seen: PENNSYLVANIA: aquarium (D, F, P).

References: as *Leptothrix rigidula* in Wolle, Bull. Torr. Club 6: 182 (1877), F. W. Alg. 321 (1887) in part.

PHORMIDIUM TRELEASEI Gom., Bull. Soc. Bot. France 46: 37 (1899).—One collection from the type locality of the species, annotated by Wolle as *Leptothrix aeruginea*: ARKANSAS: Hot Springs, *H. D. Mitchell*, Feb. 1888 (N), *comm. L. M. Underwood* (PW).

PHORMIDIUM VALDERIANUM Gom., Ann. Sci. Nat. VII Bot. 16: 167 (1892).—One specimen seen: PENNSYLVANIA: 'Phormidium obscurum' (P).

Reference: as *Lyngbya obscura* in Wolle, F. W. Alg. 298 (1887) in part.

PHORMIDIUM TENUE (Menegh.) Gom., ibid. 16: 169 (1892).—Specimens seen: PENNSYLVANIA: 'Oscillaria amphibia' (D, P). SOUTH CAROLINA: spring, Aiken, *Ravenel 497*, Nov. 1883 (PW).

Reference: as *Oscillaria amphibia* in Wolle, F. W. Alg. 310 (1887) in part.

PHORMIDIUM WEISSII Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 10 (1939).—One collection, bearing the annotation 'P. Boryanum', the *Phormidium* sp. referred to in Bull. Torr. Club 6: 283 (1879) as found in company with *Capsosira Brebissonii*: FLORIDA: *Smith*, Mar. 1878 (P, U).

PHORMIDIUM CORIUM (Ag.) Gom., ibid. 16: 172 (1892).—One specimen: PENNSYLVANIA: Mar. 1877 (F).

References: as *Oscillaria gracillima* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 311 (1887) in part.

PHORMIDIUM INUNDATUM Kütz. ex Gom., ibid. 16: 172 (1892). *P. purpurascens* var. *elegans* Drouet, Bot. Gaz. 95: 696 (1934).—Specimens seen: PENNSYLVANIA: with *P. uncinatum*, waterfalls (O, P, U), Apr. 1877 (N, P); 'Oscillaria antliaria' (D, N, P). MARYLAND: Baltimore County, *Smith*, May 1878 (U). SOUTH CAROLINA: Langley Mills, Aiken, *Ravenel 485*, Nov. 1883 (PW).

References: as *Oscillaria gracillima* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 311 (1887) in part; as *Phormidium cataractum* in Wolle, Bull. Torr. Club 6: 183 (1877) in part; as *P. fonticola* in Wolle, ibid. 6: 283 (1879); as *Lyngbya cataracta* in Wolle, F. W. Alg. 302 (1887) in part; as *Oscillaria antliaria* in Wolle, ibid. 310 (1887) in part; as *Phormidium inundatum* in Setchell, Erythea 7: 53 (1899), in Tilden, Minn. Alg. 1: 100 in part (1910), in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 11 (1939); as *P. incrustatum* var. *cataractarum* in Tilden, ibid. 100 (1910) in part.

PHORMIDIUM PAPYRACEUM (Ag.) Gom., ibid. 16: 173 (1892). *P. autumnale* var. *minus* Gardn.,[1] Mem. New York Bot. Gard. 7: 45 (1927).—Specimens seen: PENNSYLVANIA: from aquarium (P). VIRGINIA: Prince Edward County, *Smith*, Apr. 1878 (P, U).

PHORMIDIUM RETZII (Ag.) Gom., ibid. 16: 175 (1892). *P. leptodermum* var. *capitatum* Gardn., Mem. New York Bot. Gard. 7: 43 (1927).—Specimens seen: CONNECTICUT: on stones in Shetucket River, Lisbon, *W. A. Setchell*, Aug. 1885 (P). VIRGINIA: Prince Edward County, *Smith*, Apr. 1878 (P, U). SOUTH CAROLINA: *Smith*, Apr. 1878 (P, U); stream, Langley Mills, Aiken, *Ravenel 486*, Nov. 1883 (BM). MICHIGAN: Detroit, *D. H. Campbell*, 1883 (PW).

References: as *Oscillaria percursa* in Wolle, Bull. Torr. Club 6: 282 (1879), F. W. Alg. 315 (1887), in part; as *Lyngbya papyrina* in Wolle, Bull. Torr. Club

[1] The TYPE of *P. autumnale* var. *minus* in the New York Botanical Garden, PUERTO RICO: in reservoir west of Experiment Station, Rio Piedras, *N. Wille 203*, consists of well preserved *P. papyraceum*.

12: 129 (1865), F. W. Alg. 302 (1887); as *L. Phormidium* in Wolle, ibid. 299 (1887, in part; as *L. vulgaris* in Wolle, ibid. 300 (1887) in part; as *L. rupestris* in Wolle, loc. cit. (1887) in part; as *Phormidium Retzii* in Tilden, Minn. Alg. 1: 102 (1910) in part; as *P. Retzii* f. *rupestris* in Tilden, ibid. 103 (1910) in part; as *Symploca Muscorum* in Tilden, ibid. 132 (1910) in part.

PHORMIDIUM SUBMEMBRANACEUM (Ard. & Straff.) Gom., Ann. Sci. Nat. VII Bot. 16: 180 (1892).—I have discussed the North American distribution of this species in Rhodora 40: 262–263 (1938). One specimen, Farlow's *Oscillaria subtorulosa*: MAINE: Eastport, *W. G. Farlow* (P).

PHORMIDIUM FAVOSUM (Bory) Gom., ibid. 16: 180 (1892).—Specimens seen: MASSACHUSETTS: Bussey Brook, Boston (P). PENNSYLVANIA: 1875 (F); 1879 (D, P). MARYLAND: foul drain ditch, Baltimore County, *Smith*, May 1878 (P, U).

References: as *Oscillaria tenuis* in Wolle, F. W. Alg. 313 (1887) in part; as *O. limosa* in Wolle, ibid. 313 (1887) in part; as *O. nigra* in Wolle, ibid. 315 (1887) in part; as *Phormidium favosum* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 11 (1939).

PHORMIDIUM SUBFUSCUM var. JOANNIANUM (Kütz.) Gom., ibid. 16: 184 (1892).—Specimens seen: PENNSYLVANIA: insides of wooden sluice (U); pools (U); 'P. leptodermum' (N, P); 'Oscillaria tenuis var. fallax' (P). MARYLAND: mill dam, Baltimore County, *Smith*, May 1878 (P, U).

References: as *Lyngbya cataracta* in Wolle, F. W. Alg. 302 (1887) in part; as *Oscillaria tenuis* in Wolle, ibid. 313 (1887) in part; as *Phormidium subfuscum* var. *Joannianum* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 11 (1939).

PHORMIDIUM UNCINATUM (Ag.) Gom., ibid. 16: 184 (1892).—Specimens seen: NEW YORK: roadside ditch, Ithaca, *Hitchcock*, Aug. 1879 (U). PENNSYLVANIA: waterfalls (P); with *P. inundatum*, 'Oscillaria antliaria' (D, P); mill dam (N). MARYLAND: foul drain ditch, Baltimore County, *Smith*, May 1878 (P). OHIO: 'O. fontana' (P); Painesville, *H. C. Beardslee* (O).

References: as *Phormidium cataractum* in Wolle, Bull. Torr. Club 6: 183 (1877) in part; as *Lyngbya cataracta* in Wolle, F. W. Alg. 302 (1887) in part; as *Oscillaria antliaria* in Wolle, ibid. 310 (1887) in part; as *O. tenuis* in Wolle, ibid. 313 (1887) in part; as *O. limosa* in Wolle, loc. cit. (1887) in part; as *Phormidium uncinatum* in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 11 (1939).

PHORMIDIUM AUTUMNALE (Ag.) Gom., ibid. 16: 187 (1892). *Lyngbya hahatonkensis* Drouet, Bot. Gaz. 95: 698 (1934).—Specimens seen: PENNSYLVANIA: greenhouse (D, P), Dec. 1876 (P), July 1877 (P); wood in tank (N); 'Oscillaria subfusca' (P); 'O. tenuis var. fallax' (P). TEXAS: on surface of damp earth, *Ravenel* (P).

References: as *Oscillaria violacea* in Wolle, Bull. Torr. Club 6: 182 (1877), F. W. Alg. 311 (1887); as *Phormidium vulgare* var. *publicum* in Wolle, Bull. Torr. Club 6:

183 (1877); as *Oscillaria subfusca* in Wolle, ibid. 7: 43 (1880), F. W. Alg. 312 (1887); as *Lyngbya vulgaris* in Wolle, ibid. 300 (1887) in part; as *Oscillaria tenuis* in Wolle, ibid. 313 (1887) in part; as *O. aerugineo-caerulea* in Wolle, ibid. 311 (1887) in major part; as *Phormidium autumnale* in Setchell, Erythea 7: 53 (1899), in Tilden, Minn. Alg. 1: 107 in part (1910); as *Oscillatoria violacea* in Tilden, ibid. 79 (1910),

OSCILLATORIA PRINCEPS Vauch. ex Gom., Ann. Sci. Nat. VII Bot. 16: 206 (1892). *O. obtusa* Gardn., Mem. New York Bot. Gard. 7: 38 (1927). *Lyngbya gigantea* Lewis, Zirk. & Patr., Journ. Elisha Mitch. Sci. Soc. 1933: 221 (1933).—Specimens seen: NEW JERSEY: *Hitchcock* (U). PENNSYLVANIA: Rockdale, 1878 (P); 'O. imperator' (Mi); in stagnis pr. Bethlehem, Aug. 1877 (Rabenh. Alg. 2535, N, T), Aug. 1879 (Wittr. & Nordst. Alg. exs. 393a, N, PW, U); small pools (O, U); Bethlehem (B); 1879 (P); Tobyhanna, Aug. 1878 (D, N, P); stagnant waters (O). FLORIDA: *Smith*, Feb. 1878 (U), Mar. 1878 (P, U). TERRITORY OF HAWAII: *Hitchcock* (PW).

References: as *Oscillaria imperator* in Wolle, Rabenh. Alg. 2535 in part (1878), F. W. Alg. 317 in part (1887); as *O. princeps* in Wolle, Bull. Torr. Club 6: 282 (1879), Wittr. & Nordst. Alg. exs. 8: 393a (1880), F. W. Alg. 317 (1887); as *O. percursa* in Wolle, ibid. 315 (1887) in part; as *Oscillatoria princeps* in Tilden, Minn. Alg. 1: 62 (1910) in part.

OSCILLATORIA PROBOSCIDEA Gom., ibid. 16: 209 (1892). *O. refringens* Gardn., Mem. New York Bot. Gard. 7: 38 (1927).—One collection, PENNSYLVANIA: in stagnis pr. Bethlehem, Aug. 1877, with *O. princeps* (Rabenh. Alg. 2535, N. T).

References: as *Oscillaria imperator* in Wolle, Rabenh. Alg. 2535 (1878), F. W. Alg. 317 (1887), in part.

OSCILLATORIA SANCTA var. CALDARIORUM Gom., ibid. 16: 210 (1892).—Specimens seen: NEW JERSEY: Lackawanna Springs, 1879 (P). PENNSYLVANIA: in stagnant waters (P).

References: as *Oscillaria Froelichii* in Wolle, F. W. Alg. 315 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889), in part.

OSCILLATORIA SANCTA var. AEQUINOCTIALIS Gom., loc. cit. (1892). —Specimens seen: NEW YORK: Buffalo, Aug. 1876 (P). NEW JERSEY: Chapman, Nov. 1875 (P).

References: as *Oscillaria major* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 316 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889), in part; as *O. Froelichii* in Wolle, F. W. Alg. 315 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889), in part; as *Oscillatoria major* in Tilden, Minn. Alg. 1: 67 (1910) in part.

OSCILLATORIA LIMOSA Ag. ex Gom., ibid. 16: 210 (1892).—Specimens seen: VERMONT: small brooks, Bristol, *C. G. Pringle* (N). PENNSYLVANIA: 'Phormidium (Lyngbya) obscurum' (O); 'Oscillaria Froelichii' (Mi); Bushkill, Sept. 1878 (P); grown on card, Apr. 1877

(D, F, P), Apr. 1879 (F, U); shallow pools (N, U), waters (U); 1880 (N, O); stagnant waters (O); slow waters, May 1877 (N); Pennsylvania (N). MARYLAND: Garrett County, *Smith*, Aug. 1878 (U).

References: as *Lyngbya obscura* in Wolle, F. W. Alg. 298 (1887) in part; as *L. Phormidium* in Wolle, ibid. 299 (1887) in part; as *Oscillaria limosa* in Wolle, ibid. 313 (1887) in part; as *O. Froelichii* in Wolle, ibid. 315 (1887) in part; as *O. major* in Wolle, ibid. 316 (1887) in part; as *Oscillatoria limosa* in Setchell, Erythea 7: 53 (1899), in Tilden, Minn. Alg. 1: 65 in part (1910), in Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 12 (1939); as *O. major* in Tilden, ibid. 67 (1910) in part.

OSCILLATORIA CURVICEPS Ag. ex Gom., ibid. 16: 213 (1892).—Specimens seen: PENNSYLVANIA: 'Oscillaria Froelichii' (N, P); stagnant waters, Apr. 1877 (N, U).

Reference: *Oscillaria Froelichii* in Wolle, F. W. Alg. 315 (1887) in part.

OSCILLATORIA ORNATA Kütz. ex Gom., ibid. 16: 214 (1892).—One specimen: MASSACHUSETTS: Jamaica Plain, *W. G. Farlow* (P).

Reference: as *Oscillaria tenuis* in Wolle, F. W. Alg. 313 (1887) in part.

OSCILLATORIA MARGARITIFERA Kütz. ex Gom., Ann. Sci. Nat. VII Bot. 16: 216 (1892).—Specimens seen: NEW JERSEY: Port Morris, *Hitchcock*, May 1879 (U); with *Lyngbya aestuarii*, Dennisville, Cape May County (D, P).

References: as *Oscillaria Grateloupii* in Wolle, Bull. Torr. Club 7: 43 (1880), F. W. Alg. 316 (1887).

OSCILLATORIA CORALLINAE (Kütz.) Gom., ibid. 16: 218 (1892).—One specimen, FLORIDA: *Smith*, 1878 (P).

Reference: as *Oscillaria anguina* in Wolle, F. W. Alg. 314 (1887).

OSCILLATORIA TENUIS Ag. ex Gom., ibid. 16: 220 (1892). *O. tenuis* var. *levis* Gardn., Mem. New York Bot. Gard. 7: 35 (1927).—The Colorado material which Wolle labeled 'Lyngbya cincinnata' consists almost entirely of *Oscillatoria tenuis*. What he meant by "Diam. of trichomes, with sheaths, 25–30 μ" I cannot guess. Other material annotated as 'Lyngbya cincinnata' is referred in this paper to *Scytonema cincinnatum*. Specimens seen: MASSACHUSETTS: Fall River (P). PENNSYLVANIA: hot (warm) water (O, U), 1878 (D, P), 1880 (N), rolling mill (N), near Bethlehem (N); in heissem Wasser an Dampfmühlen (Rabenh. Alg. 2536, N); 'Oscillaria neglecta' (P); 'O. nigra' (N); Bethlehem (B). MARYLAND: Garrett County, *Smith*, July 1878 (U); Anne Arundel County, *Smith*, May 1878 (P); foul drain ditch, Baltimore County, *Smith*, May 1878 (P, U). FLORIDA: Race Creek, Polk County, *Smith*, Mar. 1880 (U); Fort Meade, *Smith* (U). OHIO: Painesville, *H. C. Beardslee* (O). COLORADO:

'Lyngbya cincinnata' (P). CALIFORNIA: Santa Cruz, *C. L. Anderson* (N).

References: as *Oscillaria Cortiana* in Wolle, Bull. Torr. Club 6: 182 (1877), Rabenh. Alg. 2536 (1878), F. W. Alg. 313 (1887); as *Lyngbya cincinnata* in Wolle, Bull. Torr. Club 6: 183 (1877), F. W. Alg. 296 in part (1887); as *Oscillaria chalybea* in Wolle, Bull. Torr. Club 6: 282 (1879); as *O. limosa* in Wolle, F. W. Alg. 313 (1887) in part; as *O. tenuis* in Wolle, loc. cit. (1887) in part; as *O. nigra* in Wolle, ibid. 315 (1887) in part; as *O. Froelichii* var. *neglecta* in Wolle, ibid. 316 (1887) in part; as *Oscillatoria limosa* in Tilden, Minn. Alg. 1: 65 (1910); as *O. tenuis* in Tilden, ibid. 71 in part (1910), in Drouet, Rhodora 40: 268 (1938), Field Mus. Nat. Hist. Bot. Ser. 20: 12 (1939); as *O. Cortiana* in Tilden, ibid. 81 (1910).

OSCILLATORIA AMPHIBIA Ag. ex Gom., ibid. 16: 221 (1892).—One collection: NEW JERSEY: with *O. salinarum*, docks, Jersey City Waterworks, Belleville, *Hitchcock*, July 1881 (U).

Reference: as *Oscillaria subtilissima* in Wolle, F. W. Alg. 309 (1887).

OSCILLATORIA SPLENDIDA Grev. ex Gom., Ann. Sci. Nat. VII Bot. 16: 224 (1892).—Specimens seen: NEW YORK: Lorillard's Estate Pond, Bronx Park, New York, *Hitchcock*, Sept. 1879 (U). PENNSYLVANIA: aquarium (N, P); with *Oscillatoria tenuis* (P); sluggish water (P); Lehigh, Aug. 1878 (N); spring waters (U); quiet waters (O). MICHIGAN: Detroit, *D. H. Campbell*, 1883 (PW).

References: as *Oscillaria elegans* in Wolle, Bull. Torr. Club 6: 183 (1877), F. W. Alg. 310 (1887); as *O. gracillima* in Wolle, ibid. 311 (1887) in part; as *O. Froelichii* var. *neglecta* in Wolle, ibid. 315 (1887) in part; as *Oscillatoria splendida* in Tilden, Minn. Alg. 1: 77 (1910) in part; as *Phormidium laminosum* in Tilden, ibid. 96 (1910) in part.

OSCILLATORIA ANIMALIS Ag. ex Gom., ibid. 16: 227 (1892).—One specimen: SOUTH CAROLINA: from sides of a wooden trough into which the warm water from artesian well flows, Charleston, *Ravenel 328*, July 1879 (F).

OSCILLATORIA SALINARUM Collins, Phyc. Bor.-Amer. 24: 1160 (1904); Drouet, Field Mus. Nat. Hist. Bot. Ser. 20: 13 (1939). *O. luteola* Drouet, Rhodora 39: 277 (1937).—One specimen seen: NEW JERSEY: docks, Jersey City Waterworks, Belleville, *Hitchcock*, July 1881 (U).

References: as *Oscillaria tenuis* in Wolle, F. W. Alg. 313 (1887) in part, Britton Final Rep. Geol. N. J. 2: 609 (1889).

OSCILLATORIA FORMOSA Bory ex Gom., ibid. 16: 230 (1892).—One specimen: IOWA: Iowa City, July 1878 (P).

References: as *Oscillaria limosa* in Wolle, F. W. Alg. 313 (1887) in part; as *O. nigra* in Wolle, ibid. 315 (1887) in part.

OSCILLATORIA BREVIS Kütz. ex Gom., ibid. 16: 229 (1892).—One specimen: PENNSYLVANIA: ditches, wet ground (U).

Reference: as *Oscillaria limosa* in Wolle, F. W. Alg. 313 (1887) in part.

OSCILLATORIA CHALYBEA Mert. ex Gom., ibid. 16: 232 (1892).—One specimen, FLORIDA: *Smith*, 1878 (P).

References: as *Oscillaria rufa* in Wolle, Bull. Torr. Club 6: 282 (1879); *O. limosa* in Wolle, F. W. Alg. 315 (1887) in part.

OSCILLATORIA ARTICULATA Gardn., Mem. New York Bot. Gard. 7: 34 (1927). *O. articulata* var. *circinata* Gardn., ibid. 7: 35 (1927). *O. Grunowiana* var. *articulata* Drouet, Amer. Journ. Bot. 24: 608 (1937).—One collection, NEW YORK: inundated soil, Buffalo, Aug. 1877 (F, N, O, P).

References: as *Oscillaria brevis* in Wolle, F. W. Alg. 312 (1887); as *Oscillatoria brevis* in Tilden, Minn. Alg. 1: 79 (1910) in part.

SPIRULINA SUBSALSA Oerst. ex Gom., Ann. Sci. Nat. VII Bot. 16: 253 (1892). *Arthrospira subsalsa* Crow apud Croasdale, F. W. Alg. Woods Hole, Mass. 18 (1935).—Specimens seen: MAINE: with *Phormidium submembranaceum*, Eastport, *W. G. Farlow* (P). FLORIDA: 'Beggiatoa' (P).

Excludenda

BEGGIATOA HINNULEA Wolle, Bull. Torr. Club 6: 182 (1877). *Leptothrix hinnulea* Wolle, F. W. Alg. 320 (1887). *Lyngbya hinnulea* Tilden, Minn. Bot. Stud. 1: 235 (1895). *Hypheothrix? hinnulea* Forti, Syll. Myxophyc. 336 (1907).—Wolle's original material and the Minnesota specimens distributed by Tilden in Amer. Alg. 1: 69 (1894) (FM, N, U) are truly bacterial and should find a proper place in a species of Cladothrix or related genus. One collection: PENNSYLVANIA: trenches, warm water (TYPE of *Beggiatoa hinnulea*, P).

Reference: as *Hypheothrix? hinnulea* in Tilden, Minn. Alg. 1: 140 (1910).

INACTIS AUSTINII Wolle ex Forti, Syll. Myxophyc. 351 (1907); Wolle, Bull. Torr. Club 6: 183 (1877).—The specimen labeled thus consists entirely of a lichen: NEW JERSEY: Little Falls, Passaic County (TYPE of *I. Austinii*, P).

Reference: as *I. Austinii* in Tilden, Minn. Alg. 1: 149 (1910).

LYNGBYA PHORMIDIUM var. RIVULARIS Wolle ex Forti, Syll. Myxophyc. 304 (1907); Wolle, F. W. Alg. 299 (1887). *Symploca Muscorum* var. *rivularis* Tilden ex Forti, loc. cit. (1907), as to name-bearing synonym, not as to specimens.—The specimens cited here appear to be those indicated in Wolle's description. The filaments are very poorly preserved, so that it is doubtful to just what genus

of Myxophyceae the material should be referred. Specimens distributed by Tilden in Amer. Alg. No. 67 (FM, N, U) as *S. Muscorum* var. *rivularis*, contain plants of a very different type. Material seen: PENNSYLVANIA: attached to stones in Lehigh River, 1878 (TYPE of *Lyngbya Phormidium* var. *rivularis*, P), 15 July 1879 (F, N, P).

References: as *Symploca Muscorum* var. *rivularis* in Tilden, Amer. Alg. 1: 67 (1894), Minn. Bot. Stud. 1 (1): 235 (1894), Minn. Alg. 1: 133 (1910), in Geitler, Rabenh. Krypt.-Fl. 14: 1123 (1932).

Certain specimens, the bases of reports of species of filamentous Myxophyceae in the literature, prove to be material of other groups of algae or of Myxophyceae in an unrecognizable condition. The one meager collection, FLORIDA: *Smith*, Mar. 1878 (P, U), upon which the reports of *Capsosira Brebissonii* in Wolle, Bull. Torr. Club 6: 283 (1879) and in Tilden, Minn. Alg. 1: 251 (1910) are founded contains masses of *Entophysalis?* sp. The specimen, PENNSYLVANIA: old wooden tanks (P), referred to by Wolle, F. W. Alg. 289 (1887) as *Sphaerozyga polysperma* consists of a gelatinous matrix in which small desmids (*Cylindrocystis?* sp.) are imbedded. The specimens referred to as *Phormidium julianum* in Wolle, Bull. Torr. Club 6: 283 (1879), as *Lyngbya juliana* in Wolle, F. W. Alg. 301 (1887), and as *L. lutea* in Tilden, ibid. 114 in part (1910), FLORIDA: *Smith*, Mar. 1878 (P, U), are of filamentous Myxophyceae in an unrecognizable state.

Inquirenda

Legitimate names based upon specimens of the Wolle herbarium which as yet I have been unable to find, are the following. From their published descriptions and figures, we may suppose that most of them will prove to be synonymous with species treated in this paper.

SIROSIPHON BRANDEGEEI Wolle, F. W. Alg. 274 (1887); Forti, Syll. Myxophyc. 590 (1907); Tilden, Minn. Alg. 1: 251 (1907).

ANABAENA FLOS-AQUAE var. AESTUARII Wolle ex Forti, Syll. Myxophyc. 445 (1907); Wolle, F. W. Alg. 287 (1887), Britton Final Rep. Geol. N. J. 2: 607 (1889).

NODULARIA PALUDOSA Wolle ex Forti, Syll. Myxophyc. 435 (1907); Wolle, F. W. Alg. 291 (1887); Tilden, Minn. Alg. 1: 183 (1910).

CALOTHRIX LACUCOLA Wolle, F. W. Alg. 239 (1887), Bull. Torr. Club 8: 39 (1881), Britton Final Rep. Geol. N. J. 2: 603 (1889); Forti, Syll. Myxophyc. 629 (1907); Tilden, Minn. Alg. 1: 272 (1910).

CALOTHRIX GRACILIS Wolle, F. W. Alg. 237 (1887), Bull. Torr. Club 9: 25 (1882).

ISACTIS CAESPITOSA var. TENUIOR-VIRIDIS Wolle, F. W. Alg. 245 (1887).

SCYTONEMA CORTEX f. SAXICOLA Green apud Wolle, F. W. Alg. 257 (1887).

SYMPHYOSIPHON BORNETIANUS Wolle, F. W. Alg. 261 (1887); Forti, Syll. Myxophyc. 536 (1907); Tilden, Minn. Alg. 1: 227 (1910).

TOLYPOTHRIX RAVENELII Wolle, F. W. Alg. 265 (1887), Bull. Torr. Club 6: 285 (1879); Forti, Syll. Myxophyc. 542 (1907); Tilden, Minn. Alg. 1: 234 (1910); Geitler, Rabenh. Krypt.-Fl. 14: 732 (1932); Smith, Freshw. Alg. U. S. 95 (1933).

HYPHEOTHRIX BULLOSA Wolle ex Forti, Syll. Myxophyc. 329 (1907); Wolle, Bull. Torr. Club 6: 182 (1877); Tilden, Minn. Alg. 1: 142 (1910). *Leptothrix bullosa* Wolle ex Forti pro. synon., ibid. 329 (1907); Wolle, F. W. Alg. 321 (1887).

SPIRULINA DUPLEX Wolle ex Forti, Syll. Myxophyc. 216 (1907); Wolle, F. W. Alg. 323 (1887); Tilden, Minn. Alg. 1: 90 (1910); Crow, Trans. Amer. Microsc. Soc. 46: 145 (1927; Geitler, Rabenh. Krypt.-Fl. 14: 918 (1932).

Specimens referred to in the literature under the following names appear to be lacking. Many of such specimens may be already included in this treatment, but for lack of data and proper annotation they cannot be identified with the names under which they were recorded in publications. If we can judge by Wolle's notes and drawings, however, few of these recorded names refer to species not appearing in the treatment above.

Sirosiphon crustaceus in Wolle, F. W. Alg. 274 (1887); *S. pulvinatus* in Wolle, Britton Final Rep. Geol. N. J. 2: 605 (1889); *S. compactus* in Wolle, loc. cit. (1889); *Stigonema hormoides* var. *rhizodes* in Tilden, Minn. Alg. 1: 245 (1910); *Nostochopsis* sp. in Wolle, Bull. Torr. Club 6: 283 (1879); *Fischera thermalis* in Wolle, ibid. 6: 139 (1877); *Fischerella ambigua* in Tilden, ibid. 242 (1910); *Hapalosiphon torulosus* in Wolle, F. W. Alg. 276 (1887); *H. Brebissonii* in Wolle, Bull. Torr. Club 8: 39 (1881), F. W. Alg. 276 (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889); *H. tenuissimus* in Wolle, Bull. Torr. Club 8: 39 (1881), F. W. Alg. 277 (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889); *H. fontinalis* var. *tenuissimus* in Tilden, ibid. 240 (1910).

Nostoc tenuissimum in Wolle, F. W. Alg. 282 (1887); *N. calcicola* in Wolle, ibid. 283 (1887); *N. rupestre* in Wolle, loc. cit. (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889); *N. macrosporum* in Wolle, F. W. Alg. 284 (1887), in Tilden, Minn. Alg. 1: 175 (1910); *N. comminutum, N. sphaericum, N. caeruleum, N. pruniforme* in

Wolle, Britton Final Rep. Geol. N. J. 2: 606 (1889); *N. sphaeroides* in Wolle, Bull. Torr. Club 6: 217 (1878); *N. microscopicum* in Tilden, ibid. 176 (1910); *Anabaena flos-aquae* in Wolle, F. W. Alg. 286 (1887), Britton Final Rep. Geol. N. J. 2: 606 (1889), in Tilden, ibid. 189 (1910); *A. gigantea* in Wolle, F. W. Alg. 287 (1887); *A. variabilis* in Wolle, loc. cit. (1887), in Tilden, ibid. 187 (1910); *A. stagnalis* in Wolle, Bull. Torr. Club 6: 183 (1877), F. W. Alg. 288 (1887); *A. oscillarioides* in Wolle, loc. cit. (1887), Britton Final Rep. Geol. N. J. 2: 607 (1889); *A. catenula* and *A. torulosa* in Tilden, ibid. 191, 192 (1910); *Sphaerozyga Hassallii* and *S. Smithii* in Wolle, F. W. Alg. 289, 290 (1887); *S. polysperma* in Wolle, Britton Final Rep. Geol. N. J. 2: 607 (1889); *S. variabilis* in Wolle, Bull. Torr. Club 6: 183 (1877); *S. Ralfsii* in Wolle, ibid. 7: 44 (1880); *Cylindrospermum comatum* in Wolle, F. W. Alg. 293 (1887), in Tilden, ibid. 198 (1910); *C. macrospermum* in Wolle, Britton Final Rep. Geol. N. J. 2: 607 (1889); *C. limicola* in Wolle, loc. cit. (1889); *C. riparium* in Wolle, Bull. Torr. Club 6: 183 (1877); *C. majus* in Setchell, Erythea 7: 51 (1899).

Amphithrix villosa in Wolle, Bull. Torr. Club 6: 184 (1877); *Calothrix Dillwynii* and *C. gypsophila* in Wolle, F. W. Alg. 237 (1887), Britton Final Rep. Geol. N. J. 2: 603 (1889); *C. Brebissonii* in Wolle, F. W. Alg. 238 (1887), Britton Final Rep. Geol. N. J. 2: 603 (1889); *C. Meneghiniana* in Wolle, loc. cit. (1889); *C. Orsiniana* in Wolle, F. W. Alg. 236 (1887); *C. mirabilis* in Wolle, Bull. Torr. Club 10: 20 (1883); *C. Castellii* in Tilden, Minn. Alg. 1: 271 (1910); *C. Braunii* in Setchell, Erythea 7: 46 (1899); *Mastigonema halos* and *M. sejunctum* in Wolle, F. W. Alg. 242, 243 (1887); *M. elongatum, M. fibrosum,* and *M. fertile* in Wolle, ibid. 243, 244 (1887), in Tilden, ibid. 271, 272 (1910); *M. luteum* 'sp. nov.' in Wolle, Bull. Torr. Club 6: 139 (1877); *Schizosiphon crustiformis* in Wolle, ibid. 6: 284 (1879); *Dichothrix gypsophila* in Tilden, ibid. 278 (1910); *Isactis caespitosa* in Wolle, Britton Final Rep. Geol. N. J. 2: 603 (1889); *I. fluviatilis* in Wolle, Bull. Torr. Club 8: 38 (1881), Britton Final Rep. Geol. N. J. 2: 603 (1889): *Zonotrichia haematites* in Wolle, Bull. Torr. Club 6: 184 (1877); *Rivularia dura* in Wolle, F. W. Alg. 249 (1887), Britton Final Rep. Geol. N. J. 2: 603 (1889), in Tilden, ibid. 291 (1910); *R. haematites* in Tilden, ibid. 290 (1910); *Gloeotrichia natans* and *G. Pisum* in Wolle, ibid. 604 (1889); *Gloeotrichia* sp. in Wolle, Bull. Torr. Club 7: 44 (1880).

Tolypothrix distorta in Wolle, Britton Final Rep. Geol. N. J. 2: 605 (1889); *T. pulchra* and *T. flaccida* in Wolle, F. W. Alg. 264, 266

(1887); *T. muscicola* in Wolle, Britton Final Rep. Geol. N. J. 2: 605 (1889); *T. tenuis* in Wolle, loc. cit. (1889), Bull. Torr. Club 10: 20 (1883), in Tilden, Minn. Alg. 1: 229 (1910); *T. Wartmanniana* and *T. geminata* in Wolle, ibid. 6: 185 (1877); *T. tenuis* f. *bryophila* in Wolle, F. W. Alg. 265 (1887), in Tilden, ibid. 230 (1910); *Desmonema Wrangelii* in Tilden, ibid. 235 (1910); *Symphyosiphon hirtulus, S. Castellii, S. ambiguus,* and *S. crustaceus* in Wolle, F. W. Alg. 261, 262, 263 (1887); *Scytonema Notarisii, S. Castellii,* and *S. dubium* in Wolle, ibid. 254, 255, 260 (1887); *S. ambiguum* in Wolle, Bull. Torr. Club 6: 284 (1879); *S. mirabile, S. crustaceum,* and *S. hirtulum* in Tilden, ibid. 222, 226, 228 (1910).

Schizothrix hyalina in Tilden, Minn. Alg. 1: 151 (1910); *Leptothrix tinctoria* and *L. laminosa* in Wolle, F. W. Alg. 321 (1887); *Hypheothrix tinctoria* in Wolle, Bull. Torr. Club 6: 282 (1879); *H. luminosa* in Wolle, ibid. 10: 21 (1883); *Hydrocoleum homoeotrichum* in Wolle, ibid. 6: 183 (1877), in Tilden, ibid. 137 (1910), in Smith, Freshw. Alg. U. S. 84 (1933); *H. helveticum* in Wolle, ibid. 6: 283 (1879); *H. lyngbyaceum* in Tilden, ibid. 135 (1910); *Microcoleus anguiformis* and *M. hyalinus* in Wolle, F. W. Alg. 306, 307 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889); *M. gracilis* in Wolle, Bull. Torr. Club 7: 44 (1880), F. W. Alg. 306 (1887); *M. lacustris* in Wolle, Bull. Torr. Club 8: 38 (1881); *M. chthonoplastes* in Tilden, ibid. 155 (1910); *Symploca terrestris* in Wolle, ibid. 6: 283 (1879); *Lyngbya vermicularis* and *L. membranacea* in Wolle, F. W. Alg. 297, 300 (1887); *L. arenaria* in Wolle, ibid. 299 (1887), Britton Final Rep. Geol. N. J. 2: 608 (1889); *L. vulgaris* and *L. cataracta* in Wolle, loc. cit. (1889); *L. major* in Wolle, Bull. Torr. Club 6: 283 (1879), in Tilden, ibid. 126 (1910); *Phormidium Retzii* and *P. Joannianum* in Wolle, loc. cit. (1879); *P. olivaceum* in Wolle, ibid. 6: 183 (1877); *P. arenarium* in Wolle, ibid. 7: 43 (1880); *P. membranaceum* in Wolle, ibid. 8: 38 (1881); *P. interruptum* in Wolle, loc. cit. (1881), in Tilden, ibid. 102 (1910); *P. tenue, P. subfuscum,* and *P. subfuscum* var. *Joannianum* in Tilden, ibid. 98, 105, 106 (1910); *Oscillaria detersa* in Wolle, Bull. Torr. Club 9: 25 (1882), F. W. Alg. 310 (1887); *O. leptotricha* in Wolle, ibid. 6: 183 (1877), F. W. Alg. 311 (1887); *O. cruenta* in Wolle, ibid. 312 (1887); *O. natans* in Wolle, Bull. Torr. Club 7: 43 (1880), F. W. Alg. 314 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889); *O. chalybea* in Wolle, Bull. Torr. Club 12: 129 (1885), F. W. Alg. 314 (1887); *O. Bonnemaisonii* in Wolle, Bull. Torr. Club 6: 138 (1877), F. W. Alg. 316 (1887); *O. littoralis* in Wolle, Bull. Torr. Club 9: 25 (1882), F. W. Alg. 317 (1887), Britton Final Rep. Geol. N. J. 2: 609 (1889);

O. brevis in Wolle, Bull. Torr. Club 6: 138 (1877), Britton Final Rep. Geol. N. J. 2: 609 (1889); *O. gracillima* and *O. limosa* in Wolle, loc. cit. (1889); *O. Porettana* in Wolle, Bull. Torr. Club 7: 43 (1880); *O. subsalsa* var. *dulcis* in Wolle, loc. cit. (1880); *O. crassissima* in Wolle, ibid. 9: 25 (1882); *Oscillatoria Bonnemaisonii, O. tenuis* var. *natans, O. cruenta,* and *O. chalybea* in Tilden, ibid, 68, 72, 80, 82 (1910); *Arthrospira Jenneri* in Tilden, ibid. 85 (1910); *Spirulina Jenneri* in Wolle, Bull. Torr. Club 9: 25 (1882), F. W. Alg. 323 (1887).

INDEX TO NOMENCLATURE

Amphithrix janthina **28**
villosa 57
Anabaena catenula **27**, 57
circinalis **27**
cupressaphila 33, 34
flos-aquae 34, 57
flos-aquae var. aestuarii 55
flos-aquae var. circinalis 27
gigantea 57
oscillarioides **27**, 57
scabra 27
stagnalis 57
torulosa 57
variabilis 57
Aphanizomenon flos-aquae 28
Arthrospira Jenneri 59
subsalsa 54
Beggiatoa hinnulea 54
Calothrix adscendens **30**
affinis 30
Braunii **29**, 57
Brebissonii 57
Castellii 57
crustacea 29
Dillwynii 57
Donnellii 47
Fortii 30
fusca 30
gracilis 55
gypsophila 57
Hosfordii 30
juliana **29**
lacucola 55
Meneghiniana 37, 57
mirabilis 37, 57
Orsiniana 30, 57
parietina 28, **29**
pulvinata **29**, 38
radiosa 30
radiosa var. fuscescens 30
scopulorum 29
scytonemicola var. brasiliensis 32
violacea 30
Capsosira Brebissonii 49, 55
Cylindrospermum caeruleum 28
comatum 57
flexuosum 25, 27
janthinum 28
licheniforme **28**
limicola 27, 28, 57
macrospermum 28, 57
majus **28**, 40, 42, 45, 57
muscicola **28**
riparium 57
stagnale 28
Dasygloea amorpha 42
Desmonema Wrangelii 58
Dichothrix Baueriana **30**
gypsophila 57
Hosfordii **30**
Meneghiniana 37
Orsiniana **31**
Diplocolon Heppii **34**, 35
Fischera thermalis 56
Fischerella ambigua **24**, 56
major **25**
thermalis **24**
Fremyella diplosiphon **32**
Gloeotrichia echinulata **31**
flagelliformis 32
natans **32**, 57
parvula 32
Pisum 31, **32**, 33, 57
Hapalosiphon brasiliensis 25
Braunii 24, 25
Brebissonii 56
byssoideus 34
fontinalis 25
fontinalis var. tenuissimus 56
fuscescens 25
pumilus **25**, 39, 42
tenuissimus 56
torulosus 56
Hassallia byssoidea **33**, 34, 37
Hydrocoleum glutinosum **44**
helveticum 58
heterotrichum 39, 40
Hieronymii 42
homoeotrichum 58
lyngbyaceum 58
phormidioides 40, 42
Ravenelii 39, 40
rufescens 40
tinctorium 42
versicolor 42
Hypheothrix aeruginosa 44
aikenensis 43
arenaria 43
bullosa 56
calcicola 44
coriacea f. Meneghinii 43
herbacea 44
hinnulea 54
lardacea 43
luminosa 58
pallida 40
tenax 48
tinctoria 58
turicensis 44
Inactis Austinii 54
lacustris 44
obscura 29
tinctoria 42
vaginata 44

Isactis caespitosa 28, 29, 44, 57
caespitosa var. tenuior-viridis 56
fluviatilis 44, 57
plana 44
Leptothrix aeruginea 44, 48
bullosa 56
caespitosa 28, 44
calcicola 44
herbacea 44
hinnulea 54
laminosa 58
muralis 44
ochracea 48
parasitica 30
rigidula 46, 48
tenax 48
tinctoria 58
Lyngbya aeruginosa 47
aestuarii **47**
aestuarii f. aeruginosa 47
arboricola 39
arenaria 58
cataracta 49, 50, 58
cincinnata 38, 53
dendrobia 39
gigantea 51
hahatonkensis 50
hinnulea 54
interrupta 47
inundata 47
juliana 55
lutea 55
major 58
majuscula 44, 45, **47**
membranacea 58
Naveana 40
Notarisii 39
obscura 47, 48, 52
ochracea **48**
pallida 40
papyrina 49
Phormidium 40, 42, 43, 48, 50, 52
Phormidium var. rivularis 54, 55
putealis **47**
Retzii 43, 47
rupestris 50
semiplena **47**
splendens 39
subconfervoides 46
subtorulosa 48
tinctoria 48
vermicularis 58
versicolor **48**
vulgaris 47, 50, 51, 58
Wollei 30, 45, 46
Mastigonema aerugineum 29
caespitosum 28, 44
Donnellii 47
elongatum 57
fertile 57
fibrosum 57
fuscum 30
halos 57
luteum 57
Orsinianum 31
paradoxum 32
planum 44
sejunctum 57
velutinum 29
violaceum 30
Mastigothrix aeruginea 44
turgida 29
Microchaete diplosiphon 32
Microcoleus acutissimus **44,** 45
amorpha 42
anguiformis 58
chthonoplastes **44,** 58
gracilis 58
heterotrichus f. americanus 40
hyalinus 58
lacustris **45,** 58
pulvinatus 41, 42
purpureus 44
Ravenelii 39, 40
subtorulosus 48
terrestris 40, 41, 43, 45
vaginatus 40, 41, 43, 45
Microcystis lobata 27
Nodularia paludosa 55
Nostoc alpinum 26, 27
caeruleum **26,** 56
calcicola 56
comminutum 25, 26, 56
commune **25,** 26
commune var. flagelliforme **26**
cristatum 26
flagelliforme 26
glomeratum 27
humifusum 26
macrosporum 56
microscopicum **26,** 57
Muscorum 26
parmelioides 26, **27**
piscinale **25**
pruniforme **26,** 56
riparium 26
rivulare **25**
rupestre 56
sphaericum 26, 56
sphaeroides 57
tenuissimum 56
verrucosum **27**
Nostochopsis sp. 56
Oscillaria aerugineo-caerulea 51
amphibia 49
anguina 52
antliaria 47, 49, 50
Bonnemaisonii 58
brevis 54, 59
chalybea 53, 58
chlorina 44, 48
Cortiana 53
crassissima 59
cruenta 58

detersa 58
elegans 53
Froelichii 46, 51, 52
Froelichii var. neglecta 40, 53
Froelichii var. phormidioides 46
gracillima 46, 49, 53, 59
Grateloupii 52
imperator 51
leptotricha 58
limosa 50, 52, 53, 54, 59
littoralis 58
major 51
natans 58
nigra 50, 53
percursa 49, 51
Porettana 59
princeps 51
rufa 54
subfusca 51
subsalsa var. dulcis 59
subtilissima 53
subtorulosa 50
tenerrima 44, 46
tenuis 50, 51, 52, 53
violacea 50
Oscillatoria amphibia 46, **53**
animalis **53**
articulata **54**
articulata var. circinata 54
Bonnemaisonii 59
brevis **54**
chalybea **54**, 59
claricentrosa 45
Corallinae **52**
Cortiana 53
cruenta 59
curviceps **52**
formosa **53**
Grunowiana var. articulata 54
limosa **51**, 52, 53
luteola 53
major 51, 52
margaritifera **52**
obtusa 51
ornata **52**
princeps **51**
proboscidea **51**
refringens 51
salinarum **53**
sancta var. aequinoctialis **51**
sancta var. caldariorum **51**
splendida **53**
tenuis **52**, 53
tenuis var. levis 52
tenuis var. natans 59
violacea 51
Petalonema alatum 34
crustaceum 35
densum 35
junipericola 33
Phormidium arenarium 58
autumnale **50**, 51
autumnale var. minus 49
cataractum 49, 50
congestum 28, 40, 42, 45
Corium **49**
Corium var. capitatum 47
durum 39
fasciculatum 42
favosum **50**
fonticola 49
incrustatum var. cataractarum 49
interruptum 58
interruptum var. capitatum 47
interruptum var. rigidum 24
inundatum 47, **49**
Joannianum 58
julianum 55
laminosum 53
leptodermum var. capitatum 49
luridum **48**
lyngbyaceum 43
membranaceum 58
Naveanum 40
olivaceum 58
papyraceum **49**
purpurascens var. elegans 49
Retzii 43, 47, **49**, 50, 58
Retzii f. rupestris 50
rupestre 43
subfuscum 58
subfuscum var. Joannianum **50**, 58
submembranaceum **50**
subtorulosum 48
tenue **49**, 58
tinctorium 48
Treleasei **48**
uncinatum **50**
valderianum **48**
vulgare var. publicum 50
Weissii **49**
Plectonema mirabile 33, 37, 46
Nostocorum **46**
Tomasinianum **46**
Wollei **45**, 46
Porphyrosiphon Kaernbachii 39
Notarisii **39**, 40
Notarisii var. major 39
robustus 39
Rivularia Biasolettiana 31
dura 57
echinulata 31, 32
flagelliformis 32
haematites **31**, 57
minutula 31
natans 32
paradoxa 32
Pisum 32
radians var. minutula 31
Schizosiphon Bauerianus 30
cataractae 35
crustiformis 57
Meneghinianus 37
Schizothrix aikenensis 43

arenaria **43**
calcicola **44**
chalybea **42**
Friesii **43**
hyalina 58
lacustris **44**
Lamyi **41**
lardacea **43**
Muelleri 39, **42**
Purcellii 43
purpurascens var. cruenta **40**
vaginata **44**
Wollei **41**
Scytonema alatum **34**
ambiguum 24, 58
Archangelii 36
Austinii 36
azureum 38, 39
badium 24, 25
Brandegeei 35, 36
caldarium 38, 39
calotrichoides 37
calotrichoides f. natans 37
Castellii 58
cataracta 35, 36
chrysochlorum 37, 38
cincinnatum **38**
cinereum 38
cortex 37
cortex f. brunneum 37
cortex var. brunneum 37
cortex f. corrugatum 37
cortex var. corrugatum 37
cortex f. Ravenelii 34
cortex var. saxicola 56
crispum 38
crustaceum 34, **35**, 36, 58
crustaceum var. incrustans 34, 35
densum **35**
dubium 58
evanescens 35
figuratum 33, 35, **36**
gracile var. tolypotrichoides 36
guyanense 29, **38**
guyanense var. minus 38
Hegetschweileri 36
Heppii 34, 35
hirtulum 58
Hofmannii **37**
Hofmannii f. brunneum 37
intertextum 38
junipericola 33
Kaernbachii 39
mirabile 33, 35, 36, 58
Myochrous **35**, 36
Naegelii 38
natans 37
Notarisii 36, 40, 58
ocellatum **38**
polymorphum 36, 40
simplex 36
stuposum **38**
thermale 43
tolypotrichoides 35, **36**, 37
tomentosum 37
truncicola 34
turfosum 36
varium **38**
Wolleanum 35
Sirosiphon acervatus 23
alpinus 23
argillaceus 23, 24
Brandegeei 55
compactus 23, 24, 56
coralloides 22
Crameri 24
crustaceus 56
lacustris 22
lignicola 23, 34
ocellatus 24
pulvinatus 22, 23, 56
pulvinatus f. alpinus 23
pulvinatus f. mamillosus 23
scytonematoides 37
Sommierella hormoides 24
Sphaerozyga Hassallii 57
polysperma 55, 57
Ralfsii 57
saccata 27
Smithii 57
variabilis 57
Spirulina duplex 56
Jenneri 59
subsalsa **54**
Stigonema anomalum 24
canadense 22
contortum 22
hormoides **24**
hormoides var. rhizodes 56
informe 22, **23**
mamillosum **22**
mamillosum f. robustum 22
minutum **23**
minutum var. saxicola 23
multipartitum 22
ocellatum **24**, 42
panniforme **23**, 24
robustum 22
thermale 24
tomentosum 23
Symphyosiphon Austinii 36
ambiguus 58
Bornetianus 56
Castellii 58
Contarenii 35
crustaceus 58
hirtulus 58
incrustans 35
Wollei 38
Symploca Friesiana 43
fuscescens 43
lucifuga 25, 43
muralis **46**
muralis var. minor 46

Muscorum **47**, 50
Muscorum var. rivularis 54, 55
terrestris 58
Symplocastrum Brittoniae 43
Friesii 43
Tolypothrix Aegagropila 33
bombycina 33
Bulnheimii 33
byssoidea 33, 34
distorta 38, 57
flaccida 57
geminata 58
lanata **33**
muscicola 33, 46, 58
penicillata 38
pulchra 57
Ravenelii 56
rupestris 33
tenuis **33**, 58
tenuis f. bryophila 58
truncicola 34
Wartmanniana 58
Trichormus incurvus 34
Wollea saccata **27**
Zonotrichia chrysocoma 31
haematites 57
paradoxa 32

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